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ECONOMIC ANALYSIS OF THE CONUS INTEGRATED FACILITIES SYSTEM

PRC R-1209
VOLUME IX

April 1970

Prepared for

Department of the Army
Deputy Chief of Staff for Logistics
Director of Installations

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PLANNING RESEARCH CORPORATION
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94

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by

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FOREWORD

This is one in a series of Integrated Facilities System (IFS) documents, and a detailed discussion of background information is not contained herein. Rather, reference is made to the following IFS documents:

Planning Research Corporation, D-1506, Integrated Facilities System, August 1967.

Planning Research Corporation, D-1506, Integrated Facilities System, October 1967.

Planning Research Corporation, PRC R-1104, Program Definition for the Design and Development of an Integrated Facilities System (IFS), March 1968.

PRC Technical Proposal B-68-08-471A, A Proposal for the Design and Development of an Integrated Facilities System (IFS), 30 September 1968.

Planning Research Corporation, PRC Technical Proposal B-63-08-674A, Continued Development of the Integrated Facilities System (IFS)-Phase IIB, 8 October 1969.

Planning Research Corporation, PRC R-1209, Volume I, System Definition for the Integrated Facilities System, June 1969.

Planning Research Corporation, PRC R-1209, Volume II, Part 1, Real Property Maintenance Activities (RPMA) Management Function Analysis, June 1969.

Planning Research Corporation, PRC R-1209, Volume II, Part 2, RPMA Module Analysis for the Integrated Facilities System, December 1969.

Planning Research Corporation, PRC R-1209, Volume II, Part 3, RPMA Functional Design for the Integrated Facilities System (Draft), December 1969.

Planning Research Corporation, PRC R-1209, Volume III, Part 1, Facility Requirements Analysis for the Integrated Facilities System, March 1969.

Planning Research Corporation, PRC R-1209, Volume III, Part 2, Facility Planning Module Analysis and Design for the Integrated Facilities System, December 1969.

Planning Research Corporation PRC R-1209, Volume IV, New Construction Module Analysis and Design for the Integrated Facilities System, December 1969.

Planning Research Corporation, PRC R-1209, Volume V, Assets Storage and Retrieval Module Analysis and Design for the Integrated Facilities System, November 1969.

Planning Research Corporation, PRC R-1209, Volume VI, Part 1, Facility Condition and Readiness Definition for the Integrated Facilities System, April 1969.

Planning Research Corporation, PRC R-1209, Volume VI, Part 2, Facility Condition Field Test and Impact Analysis for the Integrated Facilities System, September 1969.

Planning Research Corporation, PRC R-1209, Volume VII, ADP Analysis for the Integrated Facilities System, August 1969.

Planning Research Corporation, PRC R-2109, Volume VIII, Phase IIB Development Plan for the Integrated Facilities System, August 1969.

Planning Research Corporation, PRC R-1209, Volume X, Executive Management Requirements Analysis for the Integrated Facilities System (Draft), February 1970.

The following Phase IIB documents will be published at a later date:

R. No.	Vol.	Proposed Title
1209	XI	Implementation Plan for the Integrated Facilities System
1209	XII	Facility Allowance Criteria for the Integrated Facilities System
1209	XIII	Detailed Functional System Requirements (DFSR) for the Integrated Facilities System

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I. INTRODUCTION

A. Purpose

This report provides estimates of the resource requirements and benefits associated with the development, implementation, and operation of a CONUS-wide Integrated Facilities System (IFS). This information is needed to assess the impact of the IFS on Army resources, to indicate the magnitude of benefits that will accrue to the Army from the IFS, and to aid in management planning decisions.

B. Summary

The economic analysis of the IFS addresses the total resource requirements and benefits associated with the development, implementation, and operation of a CONUS-wide system. The study results provide information to assess the impact of the IFS on Army resources, and to indicate the magnitude of benefits that will accrue to the Army from the IFS. The analysis was conducted during a 3-month period ending November 1969, prior to completion of Phase IIB tasks including Detailed Functional System Requirements (DFSR). It is clear that, because of the limited nature and timing of the study, the economic analysis should be viewed as a tentative effort. As the DFSR and automatic data processing concepts are firmed, the assessment of costs will naturally be brought into sharper focus. The benefit analysis has brought to attention some areas where quantification in a credible manner is feasible; notwithstanding, the benefit analysis contained in this report is by no means exhaustive.

The economic analysis documented in this report was conducted in accordance with Army Regulation 37-13. The value of the benefits was found to exceed significantly the additional costs expected to be incurred by implementation and operation of the IFS. There are also a number of intangible benefits. Therefore, the introduction of the IFS appears to be an economically attractive alternative for the Army.

C. Report Organization

The remainder of this report is composed of four sections. A brief description of each section is given in the following paragraphs.

Section II, Methodology, describes the differential resource concept used to estimate net IFS costs, and lists major basic assumptions under which the analysis was conducted.

Section III, Development of Resource Implications of IFS, contains the development of functional and ADP resource requirements for implementing a CONUS-wide IFS.

Section IV, Potential Benefits, provides a quantification of tangible benefits and discusses nonquantifiable benefits resulting from IFS.

Section V, Cost-Benefit Comparison, provides summarized cost streams by category, and discounted costs and benefits.

II. METHODOLOGY

A. Cost-Benefit Analysis

The analysis contained in the following sections of this report is structured to evaluate the desirability of introducing the IFS to the Army. The criteria selected to evaluate the system are consistent with those delineated in Army Regulation 37-13, Economic Analysis of Proposed Army Investments. As discussed in the above regulation, a proposed investment can be justified in two basic ways, depending on the type of investment:

- A replacement type of investment is made when a system, facility, or piece of hardware, for example, replaces an existing system, facility, or piece of hardware. In pure replacement investment analysis, where the level of effectiveness of both challenger and current systems is constant, the maximization of cost savings is generally the guiding criterion for justification. That is, the challenger system would be selected if the present value of cost savings resulting from the system were greater than the present value of its costs.
- An expansion type of investment is made when a system, facility, or piece of hardware, for example, adds to the capabilities or effectiveness of the current system, facilities, or pieces of hardware. In this type of investment, the minimization of the expansion system's costs to achieve a level of effectiveness is generally the guiding criterion for justification. That is, the expansion system would be selected if the present value of benefits resulting from the higher effectiveness levels of the expansion system is greater than the present value of the minimum costs of the expansion system.

The proposed outlays for the IFS contain elements of both types of investment. First, the IFS represents a facilities management information system that replaces, in some aspects, a current or existing facilities

management information system. This is shown in Exhibit II-1. Each circle in Exhibit II-1 represents the resources associated with a facilities management information system. The circle identified as the IFS overlaps the current facilities system (CFS), indicating resources common to the IFS and the CFS. These common resources are not addressed in this analysis. This analysis deals with those resources required to implement the IFS, and those resources from the CFS that will be freed by implementing the IFS. The resources required, less those resources freed, represent the net resources or net cost associated with the IFS. Section III develops this net cost. Furthermore, resources are divided into two categories, functional resources and ADP resources, as indicated by the A's and B's of Exhibit II-1. For example, ADP resources required by the IFS (the A' portion), less ADP resources of the current system that will be made available by implementing the IFS (the A portion), equals net ADP resources.

Secondly, the IFS represents a facilities management information system that permits expanded levels of effectiveness to the Army in the management of its facilities. Section IV addresses the benefits associated with the expanded capabilities to manage Army facilities introduced by implementing the IFS.

The net costs of the IFS and an estimate of benefits of the IFS provide the two elements required for the cost-benefit analysis. The time-phased cost and benefit streams are discounted to present value, as discussed in Section V.

B. Limitations of the Cost-Benefit Analysis

The analysis addresses only one ADP concept for the IFS: the echelon-oriented (decentralized) processing concept. Exhibit II-2 depicts this echelon-oriented processing concept. Under this concept, processing would occur at each echelon from the installation level to HQ DA. Each echelon would maintain and update its own portion of the integrated IFS data base. Communications under the concept would be by mail, since the only identified requirement for rapid response (24 hours or less) between echelons is in the area of Real Property Maintenance Activities (RPMA) work management, which is outside of the scope of the IFS.

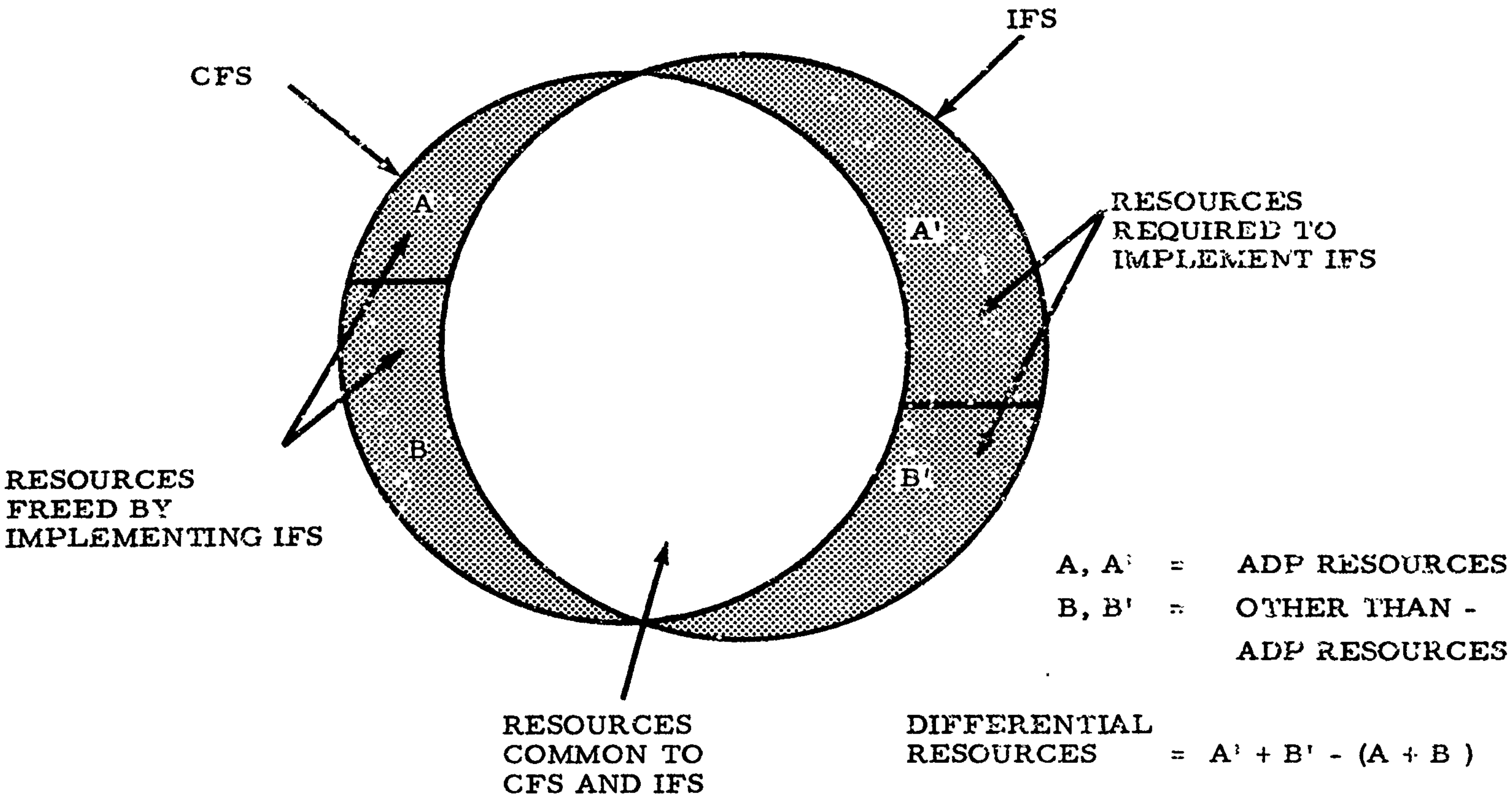


EXHIBIT II-1 DIFFERENTIAL RESOURCE CONCEPT

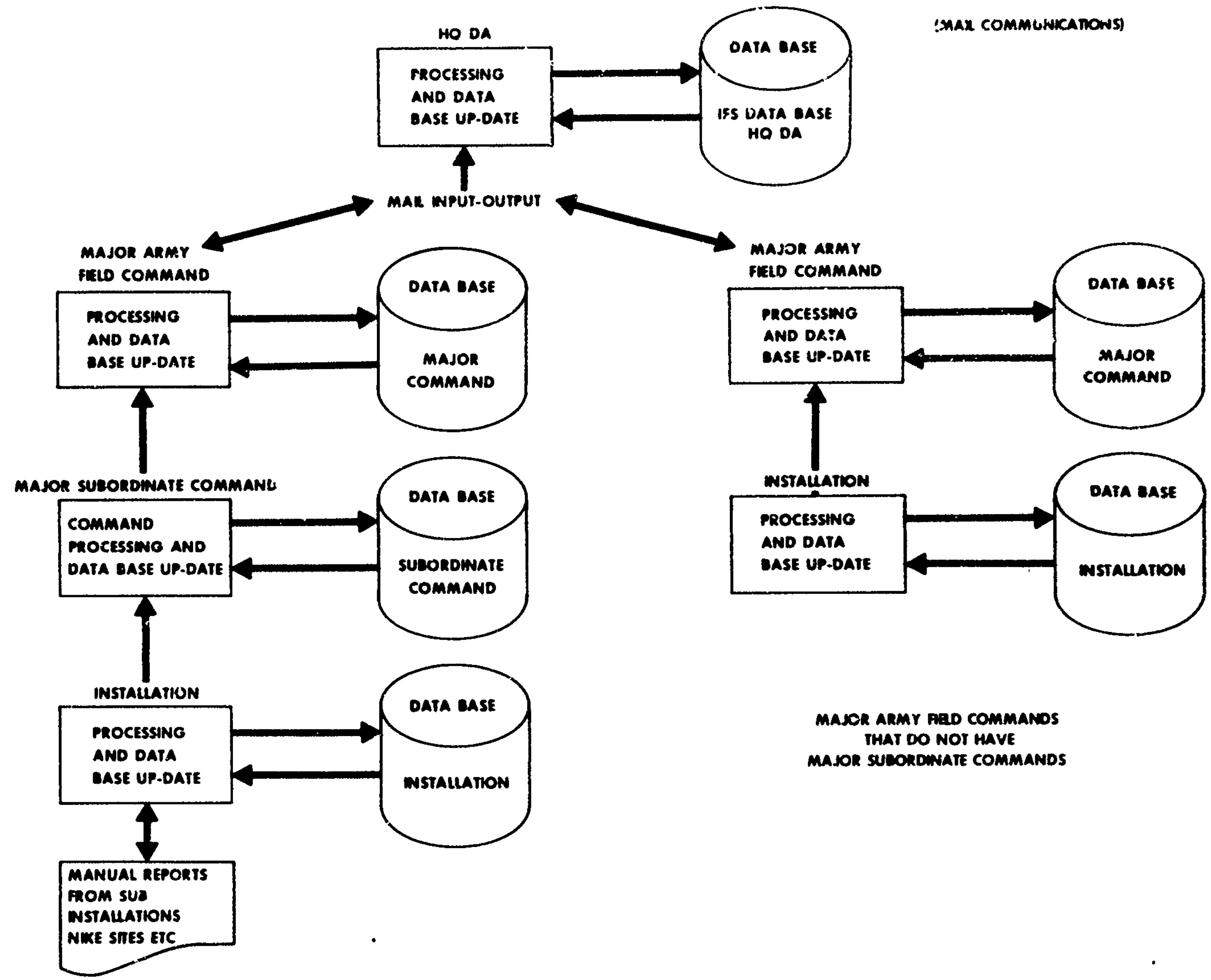


EXHIBIT II-2 ECHELON-ORIENTED PROCESSING CONCEPT

Installation-level processing would provide this response. If required, more rapid communications between echelons could be achieved under this concept at additional cost. Major significant installations—i.e., those installations with a workload sufficiently large to justify onsite ADP support—would provide processing for small installations, e.g., NIKE sites or inactive and subordinate installations for which they are responsible. Summarized data would be forwarded to major subordinate commands (MSC's) on a periodic basis or as changes to the data base occur. In major Army field commands (MAFC's), or equivalent agencies, where MSC's do not exist, [e.g., Army Security Agency (ASA). The Surgeon General (TSG)], installation data would be forwarded to the MAFC or equivalent level. In some commands there are no installations large enough to support onsite ADP support, nor are there MSC's; in these cases processing support would be provided by the MAFC.

For time-phasing of costs and benefits, a representative implementation schedule had to be assumed. Since the Army Materiel Command (AMC) has progressed further than other MAFC's in planning for and installing third-generation ADP hardware of the type envisioned for the IFS, it is assumed that the IFS will be implemented in AMC and its installations in fiscal year (FY) 1973. It is assumed that implementation will be accomplished throughout the Continental Army Command (CONARC) in FY 1974, and throughout other MAFC's in FY 1975. This implementation schedule was used in the cost-benefit analysis.

III. DEVELOPMENT OF RESOURCE IMPLICATIONS OF THE IFS

A. Functional Resource Implications of the IFS

The IFS, when implemented, will impact on the functions performed to manage Army facilities. The purpose of this section is to estimate the net resource implications in the functional areas of implementing the IFS. Since IFS is currently in the design phase and the impact on current Army facilities management systems and reporting procedures is not fully known at this time, the following analysis is intended to be only a gross estimation of functional resource implications.

The basic methodology for estimation of functional resource implications has involved a five-step procedure:

1. From an examination of IFS module analysis and design documents, identify those current management systems and reporting procedures that will be directly affected by implementation of IFS.

2. From field surveys and available manpower survey reports, estimate the functional resources associated with those current management systems and reporting procedures.

3. Relate quantitatively the replacement management systems and reporting procedures under the IFS to the current management systems and reporting procedures.

4. From the results of steps 2 and 3, estimate the gross functional resources associated with the management systems and procedures under IFS.

5. From the results of steps 2 and 4, estimate the net functional resources associated with implementation of IFS.

The functional (system) design of the IFS has been developed within the context of four basic functional areas, which will evolve into an integrated system design: real property maintenance activities (RPMA), new construction activities, assets accounting, and facility planning. The salient functional changes to be introduced by IFS are discussed in turn. Further amplification of recommended functional modifications can be retrieved directly from IFS module analysis and design documents.

1. IFS Functional Management Impact Description

a. Real Property Maintenance Activities (RPMA)

The broad outlines of the tentative RPMA system design [described in PRC R-1209, Vol. II, Part 3, RPMA Functional Design for the Integrated Facilities System, (Draft), December, 1969] are as follows. Guidance from the Office of the Secretary of Defense (OSD), Office of the Secretary of the Army (OSA) - Installations and Logistics, and Headquarters, Department of the Army (HQ DA), is sent to each level of command in turn, MAFC, MSC, and installation. The IFS functional management system will combine, consolidate, and contain RPMA data in reports that cover functional planning, programming, distribution of financial resources, and correlation with other facilities data, and that are channeled in facilities functional management channels. The IFS functional management system will provide summary amounts and details, as required, in a timely manner at any stage of the planning, programming, budgeting, execution, and review (PPBER) processes. The functional facilities management system will provide financial data needed by the financial management system.

The concept for an improved system for management of RPMA is that:

- RPMA requirements are generated at the installation level, processed through the chain of command, and reported to HQ DA early enough in the PPBER cycle to influence preparation of the Logistics Guidance Memorandum (LGM), which includes RPMA.
- Two separate but supporting channels, functional and financial, are used for management of RPMA. The present RPMA functional management channel is strengthened and distinguished from the financial management channel. Five new reports, which replace current functional management plans and reports, provide the data that flow in the functional management channel. Each of the functional management reports supports a phase of the PPBER cycle. Each report addresses the four RPMA functional categories: operation of

utilities, maintenance of real property, minor construction, and other engineering support. And each report is used by both facility users and facility maintainers at each echelon from installation to HQ DA. These five reports utilize uniform format so that all reports are similar in general outline, thereby providing to both facility users and facility maintainers similarly structured data in all reports. The major difference in these reports is in the degree of detail provided, since a high degree of detail of data can be provided for planning purposes.

The list below shows each RPMA report, its acronym, the phase of the PPBER cycle in which it occurs, and the corresponding PPBER document:

RPMA Report	Acronym	PPBER Phase	PPBER Document
Unconstrained Requirements Report	URR	Planning	LGM - Logistics Guidance Memorandum; FGM - Financial Guidance Memorandum
Financed/Unfinanced Requirements Report	FURR	Programming	Command Operating Budget (COB)
Summary Annual Work Plan	SAWP	Budgeting	Approved Operating Budget (AOB)
Midyear Review Report	MYRR	Execution	Budget Execution Review (BER)
Prior-Year Performance Report	PYRR	Review	Prior-Year Report (PYR)

A principal RPMA concept is the early, systematic generation and projection of RPMA requirements unconstrained by budget and manpower limitations. The technique proposed for determining unconstrained requirements is based on teams of inspectors. The trained and certified inspectors collect project requirements, thereby lending credibility and uniformity to the estimates, removing the paperwork burden from the post engineer shop personnel and combining collecting of facility condition data with the inspection effort. Collection procedures, which continue throughout the year, feed into a reservoir of known and estimated requirements. It is from this reservoir that requirements for the URR, FURR, and SAWP are obtained.

b. New Construction

The new construction functional design incorporates all existing Army new construction reporting information from existing management systems for input to, and use by, the IFS. The design addresses all construction programs and construction management functions (planning, programming, budgeting, execution, and performance evaluation) except OCE internal functions, by major echelon.

The design accomplishes a major change in processing from the current new construction program system. Using automation assistance at each echelon, the new construction design provides a continuously updated information base for use in program development. The new program development system is based on an integrated data base to be used in preparing annual, intermediate, and long-range programs. This data base includes:

- Installation master plan information
- New construction project data
- Short-range, intermediate-range, and long-range construction programs (SRCP's, IRCP's, and LRCP's)
- Design and construction status data

The design is as follows. Based on an analysis of total construction requirements to support forces, permanent, semipermanent, and temporary construction needs are accumulated into a new guidance document, the Army Stationing Plan for New Construction (ASPNC). This replaces the current Stationing Plan for Permanent Construction and the accumulation of specific construction projects developed in response to contingency, including Joint Chiefs of Staff (JCS) plans and special requirements.

Installation master plans are developed based on the guidance contained in the ASPNC. These master plans are used to develop new construction programs in three segments: the SRCP for the target budget year, the IRCP for the 5 years of the Five-Year Defense Program (FYDP), and the LRCP for the remaining years of the installation master plan.

Military Construction Line Item Data (DD Form 1391) are prepared in varying degrees of completion for each project in each of the three program segments, i.e., SRCP, IRCP, and LRCP. The degree of completion in general is: for the SRCP, complete, including separate 10-paragraph justification, site plans, and cost estimates; for the IRCP, nearly complete in the second and third years, with the fourth and fifth-year projects requiring less detail and less justification; and, for the LRCP, only brief descriptive data.

Data from these forms are extracted and placed in the automated new construction files, using the line item and temporary line item numbers (LIN and TLIN) as audit trail identifiers. Changes and updates, as well as annual program development, are achieved by submitting these actions (by TLIN or LIN) for approval at HQ DA. Suspense files are prescribed for tracking actions (by TLIN or LIN) at each echelon until HQ DA takes action; at that time, the files at each echelon are updated. Final action by OSA, OSD, or Congress is also put into the files by TLIN or LIN. At each annual program submission (SRCP), input for the LRCP add-on year is prepared and entered into the system by TLIN.

Status data, either project development design or construction progress, as well as fund information for the total budget cycle, are accumulated in the new construction file by TLIN and LIN.

c. Assets Accounting

One of the principal features of the IFS design is coordination of data collection and data flow, and integration of data usage. This is realized in the assets accounting design by the specification of a single source for each specific assets data element, this source being the most natural and advantageous point at which the data can be captured. Furthermore, the data follows a path through processing points and organizations such that maximum benefit may be derived from each element of data, and it will fulfill the information requirements of all Army facilities managers. The input to the data base—entered only once—at the installation level of a specific element of data, such as a building condition, automatically makes it available at all echelons of command for a full range

of reports that may contain building condition in either itemized form for lower echelons or summarized form for HQ DA level. This implies that, wherever possible, the IFS design will provide for data to be passed up the chain of command directly rather than through specialized hard-copy reports that frequently overlap in purpose, often conflict with one another, and impose a heavy reporting workload on the installation personnel.

From the IFS data base, retrievals are executed to produce various reports. These retrievals will take one of three forms: (1) special query retrievals to respond to specific questions concerning facilities, their condition, and their utilization; (2) recurring reports or exception reporting in microfilm or hard-copy format; and (3) machine readable data to pass to other IFS management areas. The medium by which reports are presented to system users will be determined during Phase IIB development. Before decisions of this type can be made, the total potential load for special query devices must be determined, and the general machine configuration to support IFS must be decided.

The IFS data coordinator designates the individual who is locally responsible for coordinating all IFS data collection, transmission, and report retrieval and distribution. He is also responsible for converting data (changing the form of the data to machine-readable form), monitoring the local data validation and correction procedures, and controlling accessability to the data base so that only appropriate data are available for users at each echelon. IFS data coordination may be performed by a separate organization created specifically for this task, or, in the case of smaller installations, by the real property reporting clerk. Each of these alternatives is feasible and the choice will depend on local conditions and the ultimate hardware configuration chosen to support IFS.

d. Facility Planning

The facility planning functional design, as described in PRC R-1209, Vol. III, Part 2, Facility Planning Module Analysis and Design for the Integrated Facilities System, December 1969, is equally applicable to the four command echelons addressed by the IFS concept, except in two significant areas.

First, the sources and mode of facility planning input data will normally vary between command echelons. Higher echelons will most likely be able to extract force planning troop lists from existing automated command force accounting sources, and therefore be less dependent on manually generated force planning input data. On the other hand, it is envisioned that the system will provide data transfer capabilities by which force planning troop lists and standard facility allowance data can be routinely passed from higher to lower echelons (AUTODIN, magnetic tape extracts, card decks) to meet facility planning and/or command evaluation needs. This concept envisions that the IFS can support both the need for rapid preliminary capabilities and impact analysis at the higher echelons (e.g., HQ DA) as well as the need for detailed subordinate level reviews and evaluations of tentative courses of actions. This concept illustrates a basic premise of the facility planning functional design effort; i.e., the IFS should support, rather than replace, facility planning activities at all echelons.

Secondly, the design excludes the allocation (stationing assignment) function at installation level, as well as associated output reports. Since the allocation function is designed to identify preferred assignments between eligible installations for existing or projected units (associated with mobilization actions, base-closures, proposed changes in force mix), it is not applicable to the case where choices between installations do not exist. Because of the many local judgmental considerations involved in the assignment of specific units to specific buildings and facilities, extension of the design of the allocation function to this level of detail was concluded to be impracticable and of questionable merit.

2. Current Functional Management System Resources

The second step in the basic methodology adopted for estimation of the functional resource implications of IFS involves a measurement of the resources associated with the current management system and reporting procedures. In this way, it is subsequently possible to relate quantitatively the resources of replacement management systems and reporting procedures under the IFS to known quantities of resources associated with the current system.

The current management systems and reporting procedures that would be most directly affected by IFS —by consolidation, automation, etc.—were selected for analysis. These are:

1. Master Planning System for Permanent Army Installations (RCS: ENG-126)
   - Building Information Schedule (BIS) DA Form 2368
   - Tabulation of Existing and Required Facilities for Long-Range Planning
   - Basic Information Maps
   - Analysis of Existing Facilities
   - Analytical Report
   - Preliminary Land Use Plan
   - Plans for Future Development
2. Military Construction Program (RCS: CSGLD-594)
   - Long-Range Construction Program
   - Intermediate-Range Construction Program
   - Short-Range (Target Year) Construction Program
   - Military Construction Line Item Data (DD Form 1391)
   - Project Justifications (10 paragraphs)
   - Project Design Criteria Memos
   - Composite Listings (DD Form 1390)
3. Inventory of Military Real Property (RCS: ENG-75)
   - Installation Inventory of Military Real Property (DA Form 2541)
   - Real Property Record Card (DD Form 2877)
   - Transfer and Acceptance of Military Real Property (DD Form 1354)
   - Cyclic Inventory (3 years)
4. Housing Capacities and Utilization of Installations (RCS: CSGLD-71)
   - DA Form 1709
5. Training Facilities Report
   - CONARC Form 244

6. R&U Technical Data Report (RCS: ENG-94)
   - DA Form 2788
7. R&U Command Analysis of Utilities Operations (RCS: ENG-113)
   - DA Form 2869
8. Real Property Maintenance Work Plans
   - Annual Work Plan
   - Long-Range Work Plan
9. Budget Development and Review (RCS: CSCAB-205)
   - Command Budget Estimate (CBE)
   - Command Operating Budget
   - Budget Execution Review
   - Prior-Year Report

Of course, other functional management systems and reporting procedures will be affected by implementation of IFS; the intent is to identify those major recurring reporting systems that are known, at this time, to be eliminated, replaced, expanded, or reduced significantly in the functional area. Many other nonrecurring reporting requirements related to facilities originate or are levied upon the Army chain of command from outside sources (e.g., Congressional or DOD inquiries). The IFS should, when implemented, significantly reduce the workload associated with one-time reporting.

Several data sources were utilized to estimate the resources associated with the above list of reports. The data sources included:

- Workload data contained in Applications for Approval of Reports, Preparing Agency Comments and Recommendations, DA Forms 335 and 1086, respectively, covered under AR 335-15
- Data developed by Project Curb, a special ongoing HQ DA project, the objective of which was to reduce the number of Army reports
- Manpower and workload data contained in Manpower Utilization Survey Report-Schedule X (RCS: CSFOR-76)
- A PRC-conducted survey of representative installations and commands

Estimates of workload associated with current reporting systems are summarized in Exhibit III-1. The workload represents the full time associated with collecting the basic input data, file maintenance, technical analysis and quality control, consolidation and preparation of reports, and management review and coordination. Although the workload estimates do not represent an absolute answer (the derivation process was heuristic), they do represent useful estimates of reporting workload magnitude.

3. Relationship of IFS to Current Functional Management System Resources

Major functional changes have been described in a previous section and need not be repeated herein. IFS system design specialists provided quantitative estimates relating on a percentage basis the functional resources associated with the full preparation of new reports under IFS to the preparation of existing reports. Full account was given to the estimated complexity and quantity of new additional data elements as well as to the elimination and avoidance of duplication of current data elements fed into the system.

4. IFS Gross and Net Functional Management System Resources

An analysis of functional personnel increments and decrements by echelon is provided in Exhibit III-2. Of prime interest among the increments in functional resources introduced by IFS are the increments required for the strengthened RPMA channel and IFS functional management and data coordination. At major installation level, a data coordinator and one or two facility inspectors per installation are included in the estimates. At intermediate command level, the IFS functional management activity would include specialists engaged in the following typical activities:

- Supervision (general engineering)
- RPMA programs (general engineering)
- Facility Planning (civil engineering)
- Facilities capacity (general engineering)
- Assets accountability (inventory specialists)
- Facilities condition (civil engineering) and verification of installation input

EXHIBIT III-1 SUMMARIZED WORKLOAD ASSOCIATED WITH CURRENT REPORTING SYSTEMS (ANNUAL WORKING MAN-DAYS)

Reporting System	Major Installation Level			MSC Level			MAFC Level		
	CONARC	AMC	Other	CONARC	AMC	Other	CONARC	AMC	Other
1. The Master Plan	360	360	360	240	120	-	720	480	360
2. Military Construction Line Item Data	300	300	300	960	480	-	360	240	180
3. Inventory of Military Real Property	240	240	240	300	100	-	60	40	30
4. Housing Capacities and Utilization of Installation	132	10	10	40	5	-	60	40	30
5. Training Facilities Report	5	-	-	10	-	-	60	40	30
6. R&U Technical Data Report	120	120	120	640	320	-	360	240	180
7. R&U Command Analysis of Utilities Operations	240	240	240	320	160	-	180	120	90
8. RP Maintenance Work Plans	264	528	528	-	-	-	-	-	-
9. Budget Development and Review (Engineer Input Only)	120	120	120	1,200	400	-	240	160	120
10. One-Time Reports	480	240	240	1,400	700	-	480	360	240

	Number	IFS Functional Management and Data Coordination	MCA Guidance	New RPMA Reports	New Asset Reports	Current RPMA Reports	Current Asset Reports	
DA	1	+4,800	+360	—	—	—	—	-5
MAFC								
CONARC	1	+2,640		+775	+135	-768	-166	-3
AMC	1	+2,400		+515	+82	-512	-104	-2
Others	8	+720		+368	+61	-404	-78	-1
MSC								
CONUSAMDW	6	+1,440		+2,468	+672	-2,100	-362	-
AMC-CMDS	8	+480		+1,000	+204	-860	-111	-
Major Instl.								
CONARC	65	+720		+469	+324	-498	-412	
Other	51	+720		+469	+324	-498	-285	

Total

Sources: Field visits
PRC Module Teams

ports	MCA Planning	MCA Programming	One-Time Reports	Gross Unit Increment	Gross Unit Decrement	Net Unit Increment	Total Net Increment	Net Personnel Spaces per Unit	Total Personnel Spaces
	-515	+480	-720	+5,640	-1,235	+4,405	+4,405	18.4	18.4
	-360	-120	-240	+3,550	-1,654	+1,896	+1,896	7.9	7.9
	-240	-80	-160	+2,997	-1,096	+1,901	+1,901	7.9	7.9
	-180	-60	-120	+1,149	-842	+307	+2,456	1.3	10.2
	-60	-192	-708	+4,580	-3,422	+1,158	+6,948	4.8	29.0
	-30	-96	-350	+1,684	-1,447	+237	+1,896	1.0	7.9
		-90	-240	+1,513	-1,240	+273	+17,745	1.1	73.9
		-90	-120	+1,513	-993	+520	+26,520	2.2	110.5
							+63,767		265.7

EXHIBIT III-2 FUNCTIONAL PERSONNEL ANALYSIS (ANNUAL WORKING MAN-DAYS)

B

- New construction (civil engineering)
- ADP coordination (computer specialists)
- Steno/clerical

The IFS functional management activities at intermediate command level would be incremental to existing Plans, Construction, Family Housing, and R&U Section functions. One person would not be assigned to each activity except at CONARC and AMC Headquarters or at AMC's Installation & Services Agency. Other MAFC's are assigned an average of three spaces to encompass the above listed specialties. At MSC level, an average of six spaces is assigned to CONUSA/MDW and an average of two spaces is assigned to AMC-MSC's, the spaces assigned being roughly proportional to current engineer personnel assigned to the two types of MSC's. At DA level, primary emphasis will be given to the strengthened RPMA channel and IFS functional management. An increment of approximately twenty spaces is assigned to DA level. The twenty spaces include the current Integrated Facilities System Office (IFSO).

Estimates of incremental and decremental workloads introduced by changed reporting procedures and MCA planning, programming, and budgeting are indicated in Exhibit III-2. At DA echelon, it is assumed that the same level of functional effort will be associated with recurring reports.

The gross increments and decrements were combined to determine net increments in functional workloads by echelon. These represent estimates of annual workload upon implementation of IFS. In the next section, functional personnel requirements for the development program are derived and combined with operating functional personnel to estimate total net functional personnel requirements.

5. IFS Development Program Functional Resources

The development program functional personnel were derived assuming that:

- A prototype IFS program will be conducted at two AMC and two CONARC major installations during FY 1972.

- An implementation schedule as follows: AMC - FY 1973, CONARC - 1974, and other MAFC's - FY 1975. This implementation schedule is merely representative for purposes of developing the economic analysis and in no way should be interpreted as either a tentative or final IFS implementation schedule.
- An extensive initial data collection effort will be required at installation level and will be accomplished by civilian personnel. A total of 290 man-years of effort is estimated, to include 189 man-years for initial facility condition data collection.
- At various echelons, IFS functional management design efforts are considered part of the development program as follows:

  DA - FY71 - FY74

  MAFC

CONARC	FY71 - FY73
AMC	FY71 - FY72
Other	FY74

  MSC

  One Army Headquarters FY72 - FY74

  One AMC Commodity Command FY72

  During the above specified years, no decrements to functional personnel are assumed to apply; hence, the functional personnel estimates are conservative.

Using the above basic assumptions, IFS development program functional personnel requirements were derived as indicated in Exhibit III-3.

6. IFS Operating Functional Personnel Summary

Exhibit III-4 indicates operating functional personnel time phased from FY 1973 - the first year of implemented operations for AMC. Operations start in FY74 for CONARC and in FY75 for other MAFC's. For implemented operations, a 25 percent military officer and 75 percent civilian personnel breakout is assumed for HQ DA and a 10

EXHIBIT III-3 IFS DEVELOPMENT PROGRAM FUNCTIONAL PERSONNEL

	FY71			FY72			FY73			FY74			FY75		
	OFF	EM	CIV	OFF	EM	CIV	OFF	EM	CIV	OFF	EM	CIV	OFF	EM	CIV
DA	4		10	10		19	9		11	9		11			
MAFC - CONARC			2	2		9	2		9						
AMC			1	1		9									
Others										8		16			
MSC - COMUSAMDW				1		5	1		5						
AMC - CMDS				-		2									
INSTL. - CONARC						6			6			161			
AMC						6			97						
Others						-									32
Total by Category	4	-	13	14		56	12		128	17		188			32
Total	17			70			140			205			32		

EXHIBIT III-4 IFS OPERATING FUNCTIONAL PERSONNEL

	FY73			FY74			FY75			FY76-FY82		
	OFF	EM	CIV	OFF	EM	CIV	OFF	EM	CIV	OFF	EM	CIV
DA							4.6		13.8	4.6		13.8
MAFC -												
CONARC				0.8		7.1	0.8		7.1	0.8		7.1
AMC	0.8		7.1	0.8		7.1	0.8		7.1	0.8		7.1
Others							1.0		9.2	1.0		9.2
MSC -												
CONUSAMDW				2.9		26.1	2.9		26.1	2.9		26.1
AMC - CMDS	0.8		7.1	0.8		7.1	0.8		7.1	0.8		7.1
Major Instl.-												
CONARC				5.6	1.8	66.5	5.6	1.8	66.5	5.6	1.8	66.5
AMC	6.2	2.0	74.1	6.2	2.0	74.1	6.2	2.0	74.1	6.2	2.0	74.1
Others							2.1	0.7	25.4	2.1	0.7	25.4
Total by Category	7.8	2.0	88.3	17.1	3.8	188.0	24.8	4.5	236.4	24.8	4.5	236.4
Total	98.1			203.9			265.7					

percent military officer and 90 percent civilian personnel breakout is assumed for other command echelons. At installation level, 25 percent of the military personnel are assumed to be enlisted personnel.

7. IFS Functional Personnel Costs

Total functional personnel costs are summarized in Exhibit III-5. Cost-per-man-year estimates were used in the calculations as follows:

Military Officer	$18,000
Military Enlisted	7,000
Civilian (command level)	20,000
Civilian (installation level)	12,000

B. ADP Resource Implications of IFS

The IFS ADP processing concept for this analysis was specified in a memorandum from IFSO, ODCSLOG, to PRC, dated 30 October 1969, entitled "Selection of CONUS ADP Processing Concept." Paragraphs 2.b. and 2.c. state:

b. The IFS will use non-dedicated, decentralized ADPE for data processing. There will be four levels of processing, Headquarters, Department of the Army (HQ DA), major Army field command (MAFC), major subordinate command (MSC), and installation, with the primary input at the installation level with roll-ups to each succeeding echelon. At most installations, the ADP service center will be utilized for IFS. Smaller installations and activities will be covered by satellization plans. Higher echelons will use available equipment located at the command's ADP service center.

c. For the purpose of IFS functional design, the assumption can be made that ADPE will be available at all echelons and that it will be "third generation" down to MSC's and a mixture of "second and third generation" at the installation level.

The basic concept specified in this memorandum is the same as the "Echelon-Oriented Processing Concept" analyzed in PRC R-1209, Vol. VII, ADP Analysis for the Integrated Facilities System, August 1969. However, the primary goal of this analysis was to evaluate four alternative ADP concepts on a relative cost rather than an absolute cost basis.

EXHIBIT III-5 FUNCTIONAL PERSONNEL COSTS (SUMMARY)

	FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77-82
Personnel Spaces							
Development	17	70	140	205	32	-	-
Operating			98.1	208.9	265.7	265.7	1,594.2
Total	17	70	238.1	413.9	297.7	265.7	1,594.2
Total Costs ($000)							
Development	332	1,276	1,952	2,810	384	-	-
Operating	-	-	1,327.6	2,969.7	3,878.3	3,878.3	23,269.8
Total	332	1,276	3,279.6	5,779.7	4,262.3	3,878.3	23,269.8

The report listed several limitations for utilizing the same methodology for estimating absolute costs. Some of these were:

- The systems used in compiling the isographs utilized only second-generation computers; hence, operating costs for third-generation computers should be less than those shown by the isographs.
- The majority of the systems used in developing the isographs were large, complex systems; hence, a low degree of reliability could be given to the costs derived from the isographs for the IFS computers at the installation level.
- The isographs utilized for estimating personnel requirements and ADP costs were compiled based on only 18 Air Force ADP systems; hence, the estimates have a limited degree of confidence.

Therefore, it was necessary to use a different methodology to estimate costs associated with third-generation computers and small second-generation computers. This methodology and resultant costs are described below.

1. Selection of Computers

Since the ADP concept specified that both second- and third-generation computers would be utilized for IFS, a documentation search was conducted to estimate the number, type, and location of computers that could be utilized by IFS. This search resulted in the list shown in Exhibit III-6. Computers listed for the Army Materiel Command are based on the AMC Five-Year ADP Program, FY 1971-1975, 15 June 1969. All are programmed to be installed within the time-frame assumed for IFS implementation. The third-generation computers listed for CONARC are either currently installed or approved, or are planned by CONARC. The number and location of all second-generation computers are based on the current inventory of U.S. Government computers published by the General Services Administration (GSA). The remainder is based on IFSO guidance.

EXHIBIT III-6 IFS COMPUTER CENTERS

	Number of Computer Centers	Computer Type
DA Hq.	1	CDC 3300
CONARC		
Hq.	1	IBM 360
MSC	5	IBM 360
Installations (3rd generation)	36	IBM 360
Installations (2nd generation)	8	IBM 1401*
AMC		
Hq. **	1	IBM 360
MSC	5	IBM 360
Installation (Depots)	12	CDC 3300
Installation (Other)	12	IBM 1401*
Other MSC's		
Hq.	6	IBM 360
Installation	12	IBM 1401*

* Or comparable second-generation computer.

** Computer may be located at Army Logistics Management Support Agency (ALMSA) or Installation and Services Agency.

2. Development of Computer Workloads

Study guidelines specify that all computers utilized by the IFS will be nondedicated systems. In order to estimate what portion of computer installation costs should be attributed to the IFS, the "Auerbach Standard EDP Reports" were utilized. These reports present graphs of processing time versus workload parameters for several standard processing problems, for various configurations of a wide range of computer types. In the analysis described below, all IFS second-generation computers were assumed to be IBM 1401's and all IBM 360's were assumed to be model 40's. The latter assumption will result in slightly high cost estimates (of both computer rental and personnel costs) for computer centers with 360/50's or 360/65's, since these models have higher processing-to-cost ratios than model 40's.

The amount of processing time required at computer centers was estimated for input processing, scheduled output processing, unscheduled query processing, and sorting. Input processing times were estimated using the Auerbach reports. The workload parameters for estimating input processing time are size of data base and update percentage. Data base sizes were computed by aggregating the estimates developed in PRC R-1209, Vol. VII, according to the computer configuration given in Exhibit III-6. A plan for satelliting installations without computers to specific installations with computers was developed so that aggregation could be made realistically. Most of the satellite installations were assigned to third-generation computers; thus third-generation computers, in general, have greater workload requirements than second-generation computers.

The other parameter required for estimating input processing time, update percentage, was also developed in PRC R-1209, Vol. VII. However, since work management is not included in the automated portion of IFS, a daily update of data bases is not necessary. Thus the daily update for RPMA of 0.4 percent was converted to a 2.0 percent weekly update. Exhibit III-7 shows the update percentage by module assumed for estimating input processing. Processing times were derived from the Auerbach graphs for each update processing cycle of each module and then aggregated into an average monthly requirement.

EXHIBIT III-7 **PERCENT OF DATA BASE UPDATING**

	Weekly	Monthly	Semiannual
RPMA	2	0	0
NC	0	10	25
AS&R	1	0	0.5
FP	0	0	10

Scheduled output processing times were estimated by PRC module personnel as factors of input processing requirements. At HQ DA and the MAFC level, it was assumed that output processing time would be equal to the input processing time. A factor of 1.5 was assumed for the MSC level and 2.0 for the installation level, where most of the detailed reports will be produced.

Computer time that will be devoted to answering unscheduled queries was assumed to be related to the sum of the input and output times. Query time was assumed to be 20 percent of the combined input/output time at HQ DA and the MAFC level, since it is anticipated that many of the "one-time report" queries can be answered at these levels after IFS is implemented. The factor for the MSC and installation level was assumed to be 10 percent.

Sorting time was also estimated by using the Auerbach reports. The only parameter required is the size of the file to be sorted. Since the size and sort frequency of files has not been determined, the following assumptions were made. The entire data base at installations will be sorted once per week. At other echelons, the data will be subdivided into files according to the number of installations represented in the data base, and each file will be sorted once per month. For example, if an MAFC data base contains information from 50 installations, then 50 files, each equal to 1/50 of the data base, will be sorted each month.

IFS utilization is the sum of the input, output, querying, and sorting times. The percent utilization was then calculated by dividing the IFS hours by the number of machine hours available. It was assumed that each computer will be available 7 hours per shift for operational processing; the eighth hour is allocated for machine maintenance. Thus, the number of machine hours available at each computer center is 7 hours x 20 work days per month, or 140 hours per month. The IFS computers and estimates of their utilization percentages are given in Exhibit III-8.

3. Data Conversion Requirements

The data processing concept specifies that the great majority of manual data conversion will be accomplished at the installation level.

EXHIBIT III-8 IFS COMPUTER UTILIZATION PERCENTAGES

	Percent Utilization *	Computer Type
DA Hq	33	CDC 3300
CONARC		
Hq.	50	IBM 360
MSC	11	IBM 360
Installations (3rd generation)	17	IBM 360
Installations (2nd generation)	12	IBM 1401
AMC		
Hq.	17	IBM 360
MSC	2.3	IBM 360
Installations (Depots)	3.1	CDC 3300
Installations (Other)	20	IBM 1401
Other MAFC's		
Hq.	1	IBM 360
Installations	7.2	IBM 1401

* Based on one-shift operation.

For this analysis, it is assumed that all input at installations will be with punched cards, and that data will be transmitted to higher echelons in the form of magnetic tape or punched cards via mail. Update volume at the installation level is assumed to be an average of 10 percent of the data base per month. The combined data base size of all IFS installations, as estimated in PRC R-1209, Vol. VII, is approximately 530 million characters. Assuming that the average input card will contain 60 characters, there must be approximately 900,000 cards punched per month. Then, assuming that an average of 50 cards will be punched and verified per man-hour, the total requirement for keypunch operators at the installation level is 110.

Higher echelons will also require keypunching support for correction and addition of data. These requirements were assumed to be 10 percent of the installation requirement at MSC level, 5 percent at MAFC level, and 3 percent at HQ DA.

Exhibit III-9 summarizes the IFS keypunching requirements, allocated by MAFC's in accordance with relative workloads. The cost per man-year is assumed to be $7,000.

4. Development and Program Maintenance Costs

The Department of the Army has estimated that 87 programmer/analysts will be required for the development of the IFS during the initial stages of implementation, and that 42 program maintenance personnel will be required after full implementation in CONUS. The average salaries are assumed to be $18,000 per year for development personnel and $15,000 per year for program maintenance personnel.

5. Annual IFS ADP Operating Costs

Exhibit III-10 summarizes the estimated annual IFS ADP costs to be incurred after IFS becomes fully operational in CONUS. The data are broken out by MAFC, MSC, and installation. The first line gives the type of computer and the second line gives the estimated number of people who should be assigned per shift to the computer center.

EXHIBIT III-9 DATA CONVERSION PERSONNEL REQUIREMENTS AND COSTS

	Personnel Requirements (Man-Years)					
	DA	CONARC	AMC	Other MAFC's	Total	Cost ($000)
Installation		62	36	12	110	770
MSC		6	4	-	10	70
MAFC		3	2	1	6	42
DA	3	-	-	-	3	21
Total	3	71	42	13	129	903

	DA HQ	CONARC HQ	CONARC MSC	CONARC Inst.
(1) Computer Type	CDC 3300	IBM 360	IBM 360	IBM 360
(2) Operations Personnel	14	11	11	11
(3) Hardware Cost (Total Rental for One-Shift Operation)	264	139	139	139
(4) IFS Utilization (Based on One-Shift Operation)	33%	50%	11%	17%
(5) No. Computer Centers	1	1	5	36
(6) IFS Hardware Cost	87	70	76	851
(7) ADP Supply Cost	5	4	5	51
(8) IFS Ops. Pers. Cost	46	55	61	673
(9) Total IFS Ops. Cost	138	129	142	1,575

ADP
Prog
Data

Annu

Notes:

Line (6) = Line (3) times line (4) times line (5)

Line (7) = Line (6) times .06

Line (8) = Line (2) times line (4) times line (5) times $10 [thousand]

A

	AMC				Other	
Inst.	HQ	MSC	Inst.	Inst.	MAFC	Inst.
IBM 1401	IBM 360	IBM 360	IBM 1401	CDC 3300	IBM 360	IBM 1401
8	11	11	8	11	11	8
71	139	139	71	264	139	71
12%	17%	2.3%	20%	3.1%	1%	7.2%
8	1	5	12	12	6	12
68	24	16	170	98	8	61
4	1	1	10	6	-	4
77	19	13	192	41	7	69
149	44	30	372	145	15	134

Operations Cost	2,873
:am Maintenance Cost	630
Conversion Cost	903
ıl ADP Operating Cost	4,406

EXHIBIT III-10 IFS ADP OPERATION COSTS ($000)

The average salary of each is assumed to be $10,000 per year. The third line gives the annual computer rental, as listed in the Auerbach reports, for a one-shift operation. Line four gives the amount of IFS utilization as a percent of time available in an 8-hour shift. Hardware costs and operations personnel costs (lines 6 and 8) are computed from lines 2-5. ADP supply cost (line 7) is equal to 6 percent of the hardware costs; the factor is derived on the basis of experience at two different industrial computer centers. The last line gives the total IFS ADP operations cost (not including program maintenance or keypunching). The total annual ADP operating costs (including program maintenance and key-punching costs) are given at the bottom of the exhibit.

6. Total 12-Year ADP Costs

Exhibit III-11 shows estimates of ADP costs to be incurred in FY 1971 through 1982. The only costs for FY71 are for development personnel and a computer for testing and checking-out programs. It is assumed that the Department of the Army computer will be utilized for this purpose and that the machine time will be equal to that required after implementation. In FY72 costs are added for pilot testing at:

- DA Headquarters
- CONARC Headquarters, one MSC, and two installations with IBM 360 computers
- AMC Headquarters, one MSC, and two installations with CDC 3300 computers

Costs for FY73 are based on full implementation in AMC with pilot testing continuing in CONARC. Full implementation is assumed in CONARC for FY74 and in the remaining MAFC's for FY75. Costs for FY76-82 assume that IFS is fully operational in CONUS.

C. Training Costs

Data coordinators and facility condition data collecters will require an IFS orientation course of approximately two weeks duration. All other additional personnel should be fully trained when assigned to IFS or will require on-the-job training only. The numbers of personnel requiring training are given below:

EXHIBIT III-11 IFS ADP COSTS (FY 71-82)

	Fiscal Year											
	71	72	73	74	75	76	77	78	79	80	81	82
Number of Personnel												
Development	87	87	80	65	50							
Program Maintenance				15	36	42	42	42	42	42	42	42
ADP Operations		24	47	118	125	125	125	125	125	125	125	125
Keypunch Operators		10	49	115	129	129	129	129	129	129	129	129
Total	87	121	176	313	340	296	296	296	296	296	296	296
Personnel Cost ($000)												
Development	1,566	1,566	1,440	1,170	900							
Program Maintenance				225	540	630	630	630	630	630	630	630
ADP Operations		240	470	1,180	1,253	1,253	1,253	1,253	1,253	1,253	1,253	1,253
Keypunch Operators		70	343	805	903	903	903	903	903	903	903	903
Total	1,566	1,876	2,253	3,380	3,596	2,786	2,786	2,786	2,786	2,786	2,786	2,786
Hardware Cost	87	337	582	1,460	1,529	1,529	1,529	1,529	1,529	1,529	1,529	1,529
ADP Supplies	5	20	35	88	91	91	91	91	91	91	91	91
Total ADP Costs	1,658	2,233	2,870	4,928	5,216	4,406	4,406	4,406	4,406	4,406	4,406	4,406

	Year		
	1973	1974	1975
Data Coordinators	38	65	13
Facility Condition Data Collectors	57	98	20
Total	95	163	33

The number of students is based on the implementation schedule discussed in the previous subsections (i.e., AMC in 1973, CONARC in 1974, and other MAFC's in 1975), and assumes one data coordinator and an average of 1.5 facility condition data collectors per installation. The following assumptions are made about the orientation course:

- It will be conducted at Ft. Belvoir, with instructors from the present faculty of the U.S. Army Engineering School.
- Three instructors are required for each class.
- The classes should be limited to approximately 35 students.
- Travel costs will be approximately $200 for each student.
- Each student will receive $25 per diem.

Training costs are shown in Exhibit III-12. Instructor costs are computed on a pro rata basis, assuming an $18,000 salary for 48 weeks. Student per diem costs are based on 14 days at $25 per day. Student salaries are not shown in this exhibit, since they are reflected in the previous subsections.

D. Total Costs of IFS

Exhibit III-13 summarizes the costs of both functional personnel and ADP personnel and equipment which were presented in the preceding subsection. Overhead costs, shown on the seventh line of the exhibit, were assumed to be 5 percent of the functional and ADP personnel costs.

EXHIBIT III-12 IFS TRAINING COSTS

	1973	1974	1975
No. Classes	3	5	2
No. Instructor-Weeks	18	30	12
Instructor Cost ($ Thousand)	7	11	5
Student Travel Cost ($ Thousand)	19	33	7
Student Per Diem Cost ($ Thousand)	33	57	12
Total Training Cost ($ Thousand)	59	101	24

EXHIBIT III-13 IFS COST SUMMARY ($000)

	Fiscal Year											
	71	72	73	74	75	76	77	78	79	80	81	82
Personnel Costs												
Development												
ADP	1,566	1,566	1,440	1,170	900							
Functional	332	1,276	1,952	2,810	384							
Operating												
Program Maintenance				225	540	630	630	630	630	630	630	630
ADP Operators		240	470	1,180	1,253	1,253	1,253	1,253	1,253	1,253	1,253	1,253
Keypunch Operators		70	343	805	903	903	903	903	903	903	903	903
Functional			1,328	2,970	3,878	3,878	3,878	3,878	3,878	3,878	3,878	3,878
Overhead	95	158	277	277	458	333	333	333	333	333	333	333
Training			59	101	24							
ADP Equipment	87	337	582	1,460	1,529	1,529	1,529	1,529	1,529	1,529	1,529	1,529
ADP Supplies	5	20	35	88	91	91	91	91	91	91	91	91
Total	2,085	3,667	6,486	11,086	9,960	8,617	8,617	8,617	8,617	8,617	8,617	8,617

IV. POTENTIAL BENEFITS

A. Approach

The benefits that will accrue to the Army as the IFS is developed and implemented depend on the goals established for the system. Therefore, those goals are briefly summarized and presented here for convenience. The goals are described more thoroughly in the PRC R-1209 reports on each module area.

Following the description of goals, the potential benefits expected in each of the functional management areas are discussed. These benefits are described in subjective terms, not because they are necessarily intangible, but because they are difficult and time-consuming to measure. Following this discussion is a description of techniques used to measure the benefits expected in the functional management area of RPMA and the measures of these benefits. Other areas were examined, but were not included in the final quantitative analysis. These areas, and the reasons they were not included, are:

- Reduced delays in stationing—lacked adequate data
- Reduced man-days lost to illness—data from the Surgeon General's Office indicate that illness does not increase as a function of facility condition.
- Reduced fire losses—data suggest that some savings are expected here, but they are perhaps insignificant since the Army's fire mortality rate is about 5 percent of the national average.

Time did not permit an exhaustive analysis aimed at measuring all the tangible benefits expected to be derived from the IFS. The objective of the quantitative analysis is to show that the stream of benefits is sufficient to offset the stream of costs when both are discounted at 10 percent, in accordance with AR 37-13.

B. Goals

The benefits expected to be derived from the implementation of the IFS depend on the goals the IFS is being designed to achieve.

A restatement of those goals will serve to set the stage for the benefits described in this section. Those goals are summarized as follows:

- To provide an automated tool for facilities requirements planning that could accept a variety of force level inputs, translate these to facility classes and categories, and compare these with assets for determination of net requirements
- To provide for collection and analysis of basic data leading to reliable estimates of economic life of a building/structure
- To provide an automated tool for determining stationing capability at discrete installations as a function of current and projected base loadings, facilities assets (including consideration of condition), and costs (both construction and repair/maintenance)
- To provide rapid access and vertical visibility of current and projected facilities assets data reflecting inventory, condition, and utilization
- To provide rapid access and vertical visibility of facilities management dollar requirements and expenditures including investment and expense dollars
- To provide rapid access and vertical visibility of technical performance data in relation to dollar expenditures
- To provide a means that will allow more effective utilization of facilities, more efficient expenditure of facilities monies, and improve Army readiness
- To provide for integration of the foregoing system elements, functions, and data forms so that (1) common data requirements will be centrally collected, uniformly prepared, and centrally stored for use by all system components; and (2) comparability among systems elements (e.g., RPMA and MCA programs) will be possible

When the IFS achieves its goals as listed above, benefits will accrue to the Army in all facilities functional management areas. They will span the planning, programming, budgeting, execution and review cycle for real property management, new construction, assets accounting, and facility planning. The approach taken in the following section is to discuss deficiencies in the existing facilities management function which will be alleviated by the introduction of the IFS, based on the goals of IFS stated above.

C. Current Deficiencies

1. Real Property Maintenance Management

Possibly more through the passage of time than by design, the management of RPMA has relied increasingly on the Army financial management system, tending to burden financial channels with various kinds of operational data--some of marginal value to financial management or budget justification. Some of the deficiencies observed in the existing system are discussed below.

a. Requirements Versus Budget Requests

Budget requests prepared at the installation level have a tendency to be based upon prior-year budget amounts and upon the overall budget guidance provided by higher headquarters--not upon an analysis of maintenance requirements. This results in the lack of a clear statement of requirements during the planning phase of the PPBER cycle. RPMA considerations are excluded from important planning documents even though decisions made on the basis of the impact of those planning documents on the RPMA budget. Thus, the resource planning process is completed and LGM and FGM decisions affecting RPMA appear to be made on the basis of insufficient information relating to real property maintenance requirements.

The maintenance of real property facilities (MRPF) floor was set by Congress in 1964 at $200 million. Since that time the floor has been increased to $280 million. If the MRPF floor is established at a level lower than that really necessary to maintain facilities, Army commanders realize greater flexibility in the use of their funding

allocations, since RPMA funds may be diverted to other purposes if the MRPF floor is low. Based on the data in Exhibit IV-1, the Army has consistently obligated more funds than those prescribed by the MRPF floor. Although the floor has been exceeded in every year since it was established, the backlog of essential maintenance and repair (BEMAR) has increased from about $100 million to over $200 million. These statistics suggest that requirements are not being funded, perhaps because requirements are not well understood.

b. RPMA Funding Program Confusion

Funds for RPMA are scattered throughout the Army management structure. Within Operations and Maintenance, Army (OMA), maintenance funds are included in the base operations budget program accounts (2X09) under each of the nine budget programs. In the OMA program, visibility of RPMA is afforded the budget program director, but only in a data structure two levels below the budget program (that is, BP 2000, base operations 2009, and RPMA 9050, 9060, 9070, and 9080). Inadequate comprehension of RPMA requirements encourages the budget program director to deal with base operations as an entity without full consideration of the RPMA portion of base operations. There appears to be considerable reluctance to have RPMA personnel provide more than token advice to the budget program directors, compounding the confusion.

The post engineer of an installation must look in many directions for funds, particularly if he has other services or allied tenant units on the installation.

RPMA data are now reported in five separate reporting systems (Listed in Exhibit IV-2) utilizing five different forms of RPMA data identification. The data in these five structures overlap and are duplicative in many cases. The information reported in one structure often cannot be correlated with the same type of information reported in another structure. Although methods have been developed for translation from one structure to another, the problem of data inconsistency remains.

EXHIBIT IV-1 DIRECT OBLIGATIONS, O&MA ($MILLIONS)

	FY 1964	FY 1965	FY 1966	FY 1967	FY 1968	FY 1969	FY 1970
Real Property Maintenance Activity (RPMA) 9050-9080							
Budget Year Estimate		409.4	372.5	423.1	485.5	519.2	454.4
Following Year Estimate	404.3	417.3	424.0	493.6	514.6	506.5	
Actual	417.9	439.4	463.9	586.3	602.6		
Maintenance of Real Property Facilities (MRPF)	260.0	261.8	273.8	326.3	389.2		
MRPF Floor	239.0	236.0	225.0	264.3	280.0	280.0	225.4
BEMAR (9060)							
Start of Year	108.8	95.8	75.7	59.7	71.5	207.8	211.2E
End of Year	95.8	75.7	59.7	71.5	207.8	211.2E	242.2E

Source: Department of the Army, Operating Resources Management Office, Base Operation, FY 19-- Presidential Budget, Oper. and Maint., Army Appropriation.

EXHIBIT IV-2 NONUNIFORM IDENTITY AND FRAGMENTED CONTROL OF RPMA DATA*

Reporting System	Organization Controlling Reporting System	Form of RPMA Data Identification
1. OSD Reports		
MORP	COA	RMS Functional
Annual Report on RPMA	R&U Div., OCE	Categories 9, 10, 11, 12
Family Housing O&M Costs	COA/DCSLOG	AMS 1920.X1, 1920.X2, 1920.X3 and 1920.X4 - costs
Family Housing O&M Costs	DCSLOG	AMS 1920 - Report furnished by installation allows for determination of RMS functional category
2. Budget Reports	COA	AMS, 9050, 9060, 9070, 9080, and subactivity accounts
		AMS 1920 - Obligations
3. Technical Reports		
TDR	R&U Div., OCE	AMS plus other non-AMS technical data covering RPMA
CAUO Report	R&U Div., OCE	
4. RPMA Planning Documents		
AWP	Post Engineer	Reported by shops and category of work (standing operating orders, individual job orders, projects) not completely relatable to AMS
LRWP	Post Engineer	
5. Real Property Inventory and Facility Utilization Reports	Real Estate Division of OCE	FC&CCC

*PRC R-1209, Vol. II, Part 1, Real Property Maintenance Activities (RPMA) Management Function Analysis, June 1969.

c. Dispersed Responsibility

A major deficiency in RPMA management is the lack of definition and clear delineation of responsibilities. The funding for RPMA is scattered throughout the Army management structure, as indicated above, and this is partially responsible. The present organizational concept for RPMA management appears to have considerable redundancy in both function and responsibility between the RPMA office, ODCSLOG and the Office of the Chief of Engineers, Repairs and Utilities (OCE R&U) Division. It is difficult to clearly define responsibilities of these organizations in the PPBER cycle. The OCE and the RPMA offices are both involved to varying degrees, and in some cases are performing similar functions. As a result, no focal point for RPMA management with clear lines of responsibility is evident.

d. Misallocation of Funds

RPMA funding is determined primarily by budget program and appropriations directors who do not presently have adequate comprehension of RPMA requirements. They are mission-oriented and, in the OMA appropriation, must depend on the Operation Resources Management and the RPMA offices to allocate the RPMA budget among the base operation accounts. For base operations, these directors provide budgetary control insensitive to RPMA requirements. RPMA must compete with other base operations requirements, and mission-oriented managers tend to treat the RPMA budget more severely than that for other base operations. This is typified by the allocation of funds for Ft. Benning during FY68. The installation Program Budget Advisory Committee (PBAC) gave the post engineer 68 percent of his budget amount and gave all other activities from 85 percent to 92 percent of their budget amounts. Recognizing that certain RPMA functions, such as pay and allowances, utilities, fire prevention and protection, etc., must be fully funded, the impact on the post engineer's capability to perform his maintenance tasks is quite serious.

e. Year-End Crash

The amount of money obligated during the month of June is from two to four times as large as the amount of money obligated during any other month of the year for MRPF (see Exhibit IV-3). One reason for the large increase in obligations during June is that reallocations of funds take place toward year-end. For example, at one installation the post engineer's budget was cut by $200,000 in March, and then allocated $2.5 million in June for obligation before 30 June. Some post engineers are prepared to receive extra funds during June; they prepare contract documents ahead of time in order to obligate the large sums of money released to them during June. It is in this manner that experienced post engineers place themselves in a position to allocate their funds more efficiently. Less experienced post engineers are caught unaware, and by the nature of the contracting procedures and the short time involved, they must usually allocate their additional funds to major projects that can be developed quickly, such as resurfacing all streets and hardstands, painting blocks of buildings, reroofing blocks of buildings, etc. Although the maintenance performed under these contracts is perhaps necessary, it is probably not the most critical maintenance, and that may be one reason why BEMAR continues to increase year after year.

f. Continuing Deterioration

It appears that Army facilities continue to deteriorate despite the facts that an MRPF floor is established, BEMAR is reported, obligations continually exceed the floor, and obligations continually exceed the total RPMA budget. The backlog of essential maintenance and repair, as an indicator, shows that the Army facilities are experiencing increased deterioration each year; BEMAR has increased by a factor of 2 since 1964, a far greater increase than that accounted for by inflation alone. Only those projects amounting to $10,000 or more are included in BEMAR; therefore, the backlog is really somewhat larger than the amount reported.

EXHIBIT IV-3 MRPF CUMULATIVE DIRECT OBLIGATIONS
($ MILLIONS)

	Fiscal Year					
	'64	'65	'66	'67	'68	'69
July	28	13.6	16.5	N.A.		
Aug	48	27.1	33.7	47.8		
Sep	78	55.5	62.1	75.6	70	
Oct	97	77.9	84.1	98.8		
Nov	109	96.4	104.7	114.7		
Dec	126	114.1	122.8	150.3	144	129
Jan	141	132.7	141.5	169.7		151
Feb	147	147.8	159.9	187.5		170
Mar	169	169.2	180.1	214.7	198.3	194
Apr	193	188.1	205.9	238.9	223.9	
May	213	209.8	230.2	268.1	255.6	
Jun	260	261.8	273.8	326.3	389.2	
Floor	239.0	236.0	225.0	264.3	280.0	280.0

g. Inadequate RPMA Standards

The Department of the Army has developed a wide range of RPMA standards, targets, factors, criteria, directives, guidance, and policies (herein referred to as standards). Some are purposely worded in general terms; others are more specific. Some establish measures of the efficiency with which a post engineer expends allocated resources, and these are well covered in existing reports. Others provide rules on the extent of the support or service a post engineer should furnish. Performance against this type of standard is not well covered in existing reports. All standards are diffused through a variety of documents and publications.

The further development of standards would permit more objective decisionmaking. Questions emerging from the analysis of existing RPMA standards are:

- Can established RPMA standards be used as an aid for determining and justifying RPMA resource requirements?
- Can existing RPMA standards be used as a basis for reporting the extent to which RPMA activities actually provide the support and services authorized by DA policy?
- Is the flexibility currently afforded the post engineer operating to his advantage?

h. RPMA Summary

The IFS will certainly not cure all of the ills listed above; it will provide facilities managers with the tools necessary to alleviate some of the problems associated with each of those deficiencies. The system will provide rapid access to needed data, vertical visibility from HQ DA to the installation level, and will provide for the integration of data collection and reporting systems. Although difficult or in some cases impossible to measure, the benefits associated with the alleviation of some of those problems mentioned above are most significant.

2. Facility Planning

The facility planning module of the IFS will provide an automated tool to assist the Army's facility managers in the execution of their tasks at all echelons of command. Of necessity, these tasks in the past have had to be manually performed with very little automated assistance [a limited capability system (the Stationing Capability System) is available at HQ DA but is not available at other echelons of command]. The facility planning module will provide an automated tool that will be particularly useful at the higher echelons where vast quantities of data must be considered in making facilities management decisions; however, it will be a useful tool at all echelons, even at the installation level. Of particular importance is the capability it will provide to the higher echelon facilities planner to make tentative decisions based on considerations of a wide data base without having to involve countless number of people down through the chain of command, as is the case with the current manual system. This is not to say that final decisions can be made at the higher echelons with no reference at all to the lower echelons (this is particularly true in the formal programming and budgeting areas), but it will certainly narrow the scope of decisions that must be verified at the lower echelons and thus lessen the impact on the lower echelons. In addition, the availability of the model at the lower echelons, operating on the same data base as used at the higher echelons, will assist them in reviewing and commenting on tentative decisions made at the higher echelons.

In general, the functional design of the facility planning module will provide a capability to: compute and display facility requirements information for a given force structure, relate such requirements data to facility assets information (existing and programmed, including condition information), and derive detailed as well as summary expressions of facility deficits and residuals, with their associated resources impacts and facility readiness implications.

Specifically, the facility planning module will lead to system capabilities for:

- Developing force/unit stationing alternatives including mobilization stationing responsive to operational and economic considerations, and effectively considering the time-phasing of facility requirements and facility assets availability
- Assessing the adequacy of present and projected facility programs in meeting facility requirements
- Determining the impact of changes in Army forces and/or missions on facility requirements and facility assets
- Relating RPMA and new construction needs to units and functional activities, either existing or postulated
- Considering facility condition information in the stationing process and in associated displays of facility resource needs
- Identifying opportunities for more efficient utilization of facility resources (RPMA and new construction alternatives) in satisfying facility requirements
- Assisting in the selection of base closure/activation alternatives and their facility-related impacts
- Developing facility readiness information in a form that would contribute to better justification for, and allocation of, facility-related dollar resources
- Considering a large number of different facility types and Army installations in the system stationing and assets assessment processes
- Incorporating special area/command-oriented considerations into the above types of planning activities (e.g., variations in facility allowance criteria, cost factors, and stationing policies)
- Determining the impact of various policy options (e.g., changes in facility allowance criteria) on facility requirements and facility assets

The attainment of the above capabilities in the design of the facility planning module will alleviate many existing problems. Some of those problems and deficiencies are discussed below.

a. <u>Assessment of Adequacy of Present Facility Programs</u>

Existing facility planning procedures and systems are structured to provide an ineffective capability of developing and analyzing statements of Army-wide facility requirements. Existing facility requirements and standard criteria are not sufficiently explicit for developing, evaluating, and validating those requirements. Approved RPMA funding levels are not derived from explicit RPMA requirements; as a result, existing procedures and systems do not provide meaningful capabilities for assessing the impact of approved RPMA funding levels on specific installation facility capabilities, or upon overall installation readiness. Lack of facility asset capabilities and utilization information in the RPI (real property inventory) reporting system generally precludes meaningful comparison of existing assets and actual facility requirements, except on a case-by-case basis.

b. <u>Impact of Changes and Forces or Missions</u>

The determination of facility planning data for an increasingly expanding variety of force structure postulations in Army force/resource documents demands evaluations that are both responsive and adequately informative. Detailed facility planning information is presently determined at the installation level in planning areas such as capability, mobilization, and installation master planning. Detailed requirements and asset capabilities data relatable to specific facilities either are not now available at the higher echelons or exist in forms that do not permit rapid access and analysis. The separation of planning and data reporting systems leads to gaps in data availability and redundancies in data reporting.

Force changes and mission changes affect all facility planning management functions. These include new construction, repair and maintenance, facility utilization, and disposition. Under the existing

system, it is necessary for the individual installations affected by changes to determine their full impact on facilities.

Statements of facility requirements to support various proposed stationing actions are often inconsistent as reported by individual installations. The time to process those statements through appropriate command echelons is excessive, and initial estimates developed as a result of facility impact statements often vary widely from actual cost subsequently experienced.

The selection of stations for new units or units being moved have been less than optimal in the past. One reason is that frequently the selection is based on barracks space alone without considering the unit's need for training ranges and maneuver areas, and maintenance facilities. For example, two armored battalions were stationed on an installation that had adequate barracks space. Upon arrival, the battalions found a total lack of training ranges and maneuver area, and the maintenance facilities were inadequate.

c. Unit Relocations

Prior to making a decision on relocating a unit division, brigade, battalion, etc.--many factors must be considered. The availability and condition of facilities is a major factor in the decision. Examples of delayed unit relocations, where the delay was caused by inadequate information on facilities availability and condition, could not be found. In every case, other factors seem to be equally important contributors to the delay.

The search for those examples, examples which may have permitted the measurement of the savings due to reduced troop delays, led to the identification of another potential benefit expected to result from IFS. When preparing to make a decision on the place for relocating an Army unit, the decision usually must be made very quickly--perhaps within 2 weeks. Therefore, only a very few alternative locations may be considered in such a short span of time. One may begin his analysis by considering perhaps 30 to 35 alternative locations, but, because of the quick response demanded, one must narrow those

alternatives down to 5 to 10 on the basis of a cursory examination relying heavily upon the knowledge of the individuals making the analysis. Then, the 5 or 10 remaining candidates will be examined in more depth. There are cases where such hasty analyses have led to the placement of Army units in installations where the additional costs to make that installation suitable for the particular type of unit placed there are greater than they would have been at a more suitable installation. Admittedly, the criterion for locating an Army unit is seldom as simple as minimizing the additional cost of making an installation suitable. However, cost is and should be an important consideration in the decision.

IFS will permit more alternative locations to be examined in depth, and permit that examination to be conducted rapidly. One possible method for estimating the potential benefit to be realized by IFS in terms of dollars saved due to better decisions would be to isolate the additional costs of new or expanded facilities incurred by various installations in the period immediately following the placement of a new unit on those installations. The dollar amount spent for new facilities and for rehabilitating an installation would be an indication of the upper limit of the potential benefit to be derived from IFS. This amount has not been derived, but is perhaps far greater than the potential benefit due to reduced fire losses.

d. Economic Considerations

In the previous subsection, a brief mention was made of the importance of economic considerations; an example was cited. This subsection provides a more detailed discussion of those considerations--in particular, analyses of economic alternatives to provide for the more efficient utilization of facility resources.

Economic alternatives may be identified by conducting economic analyses such as an analysis of investment and operating costs. The Army has been encouraging the submission of construction projects justified on the basis of economic savings through AR 37-13 and the

annual MCA Program Guidance. But few projects have been submitted, and even fewer approved. Installation closure and inactivation studies are nearly all initiated by the OSD.

One reason for the limited consideration of alternatives is that accurate, timely data to the level of detail required for an economic analysis are often not available, or not readily available, to the echelon performing the analysis. For example, maintenance and repair expenses cannot readily be identified by building or by individual facility.

Examples where economic analysis may be useful include the examination of the impact of deferring maintenance, of building versus leasing space, and--for Class II installations--of make versus buy comparisons. The methodology for conducting analyses of this sort is well known; their conduct is inhibited primarily by the lack of available and accurate data.

A sound basis for estimating the cost associated with the activation, inactivation, or closure of an installation does not exist within the current facilities management system. To develop alternative plans with possible reassignments, showing comparative costs, requires three months or more under the existing system. Even then, many of the estimates have no sound basis. Stationing decisions made on the basis of unsubstantiated analysis can only lead to inefficiencies in the allocation of Army resources.

e. Facility Condition

A discussion of the applications and resultant benefits of facility condition information is presented in PRC R-1209, Vol. VI, Part 2, Facility Condition Field Test and Impact Analysis for the Integrated Facilities System. For convenience that section is summarized here. The current facilities management system makes no provision for the determination and reporting of the condition of facilities. Therefore the deficiency in the current system may be stated most briefly: facility condition information is nonexistent within the current system.

The applications and benefits identified to date are of three general types: facility condition status, budget program justification, and facility planning and stationing.

A uniform method for expressing the condition of facilities will be provided by selected condition data elements. Those data elements will provide a common language for the layman and for the engineer. Information on the relative condition of facilities and the estimated funds required to raise the level of the condition of facilities to prescribed Army standards will be provided at all command levels, in the detail pertinent to each level of command. A capability will be provided for comparing the condition of like facilities throughout the Army in terms of condition ratings and work requirements.

The information will assist facility managers in assessing the adequacy of facilities in justifying funds, and in assigning missions and forces, including an indication of the need for additional resources. As the system is currently conceived, condition information can be provided on an exception basis to pinpoint problem areas and provide selected information to answer specific questions. Because facility condition is a key component of facility readiness, the proposed condition system is the first step in the evolution of an Army facility readiness system that will be incorporated in IFS.

One may argue that the measurement of the backlog of essential maintenance and repair serves as an indicator of the condition of Army facilities. That measurement is perhaps useful as a gross indicator. However, the development of an effective measuring system depends on the development of a set of definitive standards for facilities, and that is what is proposed above.

3. New Construction

The new construction module of IFS has been designed to alleviate deficiencies in the current system. Volume I of PRC R-1209, System Definition for the Integrated Facilities System, pp. IV-68 through IV-77, lists nine deficiencies related to current practice in

the new construction management area. A summarized discussion of those deficiencies will serve to indicate some of the intangible benefits expected from IFS.

a. New Construction Funding Priority

In the general functional area of new construction, there are several funding sources; the two most important sources are Military Construction, Army, (MCA) and Procurement of Equipment and Missiles, Army (PEMA). One major problem with regard to new construction has to do with the priority associated with MCA. At the present time, the establishment of priorities for MCA does not account adequately for operational needs, nor for the additional costs that may be incurred through a delay in approval. PEMA construction is kept separate from MCA in order to ensure that the construction is accomplished by the time the facility is required for operations.

b. The Current Approach to the Submission of MCA Projects

The design and submission for approval of military construction projects is a time-consuming and costly task. Many projects are conceived, designed, and submitted to higher headquarters for approval, but are subsequently disapproved. Considerable manpower is required, not only for the preparation of those projects, but for their review at various echelons in the chain of command. The projects are submitted in accordance with guidance from above, and the projects approved are not necessarily the projects with the highest Army priority. Additional information at DA level should permit the guidance to be more selective, thereby increasing the ratio of approved to submitted projects.

Less than 20 percent of the hundreds of new MCA projects submitted annually by all the installations even reach congressional committees for consideration. An analysis at the 4th Army for FY 1968 indicates that only 12 out of 77 (about 15 percent) commandwide projects were authorized for construction.

c. Other New Construction Program Deficiencies

There are a number of other deficiencies noted in PRC R-1209, Vol. I, System Definition for the Integrated Facilities System. Some of the problems caused by those deficiencies will be provided a basis for solution with the implementation of IFS. As an example, one of the problems discussed in detail in the above reference has to do with capacity data for structures and facilities. It is stated that there is insufficient guidance, an incomplete glossary of terms, and inadequate methods of calculation to develop capacity data for structures and facilities. The facility planning module of IFS will provide for the preparation of specific measurement factors and recommend that additional allowance criteria be established for use in developing facility requirements.

4. Assets Accounting

The principal Army asset reporting system is the real property inventory (RPI), designed to provide real property accountability information to the Department of the Army and the Office of the Secretary of Defense. It was not designed for the day-to-day facility management at the local level or for the more general-purpose Department of the Army facility planning. As a result, serious problems with respect to data reliability arise when the RPI is applied to these management functions. These problems are a result of the 3-month time lag in data reporting, the shortage of clerical help in maintaining the RPI at some installations, variations in the application of the standards for updating the RPI from station to station, and limited usefulness that is derived from the RPI locally. Were the RPI more useful at the installation level, people at the installation level would take more interest in its preparation.

The implementation of IFS has the potential for alleviating a number of the deficiencies cited below:

- The present technique utilized for collecting, keypunching, verifying, and transmitting the data to OCE results in an extensive time lag between the initial modification or acquisition of a facility and the time when it is finally reflected in the RPI.
- Several current Army reports give a limited amount of information concerning the capacity of Army facilities. These reports have been found to be less than adequate for the management functions envisioned for IFS.
- The existing Facility Classes and Construction Categories Codes do not provide an adequate framework for describing the variety of functions performed by Army facilities. This is particularly evident in many installations where the "other" category of facility is used to designate the function of particular buildings.
- The present system does not provide an adequate means for associating particular buildings with the expenditure of Army management system funds for their maintenance.
- The RPI does not provide an adequate means for describing the location of groups of buildings within an installation. This is of particular importance to a facility planner when considering large installations with widely separated building complexes. The problems of unit integrity and inefficient building utilization become extremely difficult when buildings are widely dispersed at an installation.

The resolution of the deficiencies discussed above will certainly be beneficial to the Army. However, due to the short time allotted to this analysis, and due to their intangible nature, the benefits have not been measured. Therefore, those benefits are excluded from the next section, which compares costs and measured benefits.

D. Quantification of Partial Benefits (RPMA)

The benefits attributable to the IFS may be stated in terms of dollars saved—that is, an actual reduction in dollars spent in each of the functional management areas—or they may be in terms of improved effectiveness or efficiency in managing Army facilities. The contention here is that the introduction of the IFS would permit a reduction in facility costs (recurring and non-recurring) while maintaining current management effectiveness; conversely, if facility costs are kept constant at their current level, IFS will permit facilities managers to improve their effectiveness. The consistent increase of the BEMAR in recent years (discussed in subsection C.1.a) indicates that current RPMA expenditures are insufficient to keep the condition of facilities at their current level, and that the current level is perhaps inadequate on the average. However, one way to measure the value of an improvement in the management of Army facilities is to estimate the amount of resources which could be saved by allocating those resources more efficiently, while holding constant management effectiveness.

That is the approach employed in the examination of the RPMA. There is no implication that the RPMA budget will or should be reduced by the amount of "savings" estimated; the amount estimated is merely an indicator of the value of the benefits which may be ascribed to the IFS in the RPMA functional management area. It is entirely possible that the IFS will expose deficiencies in the management of Army facilities to the extent that an increase in the RPMA (and other functional areas) budget will occur, and that the increase will be based upon sound economic considerations.

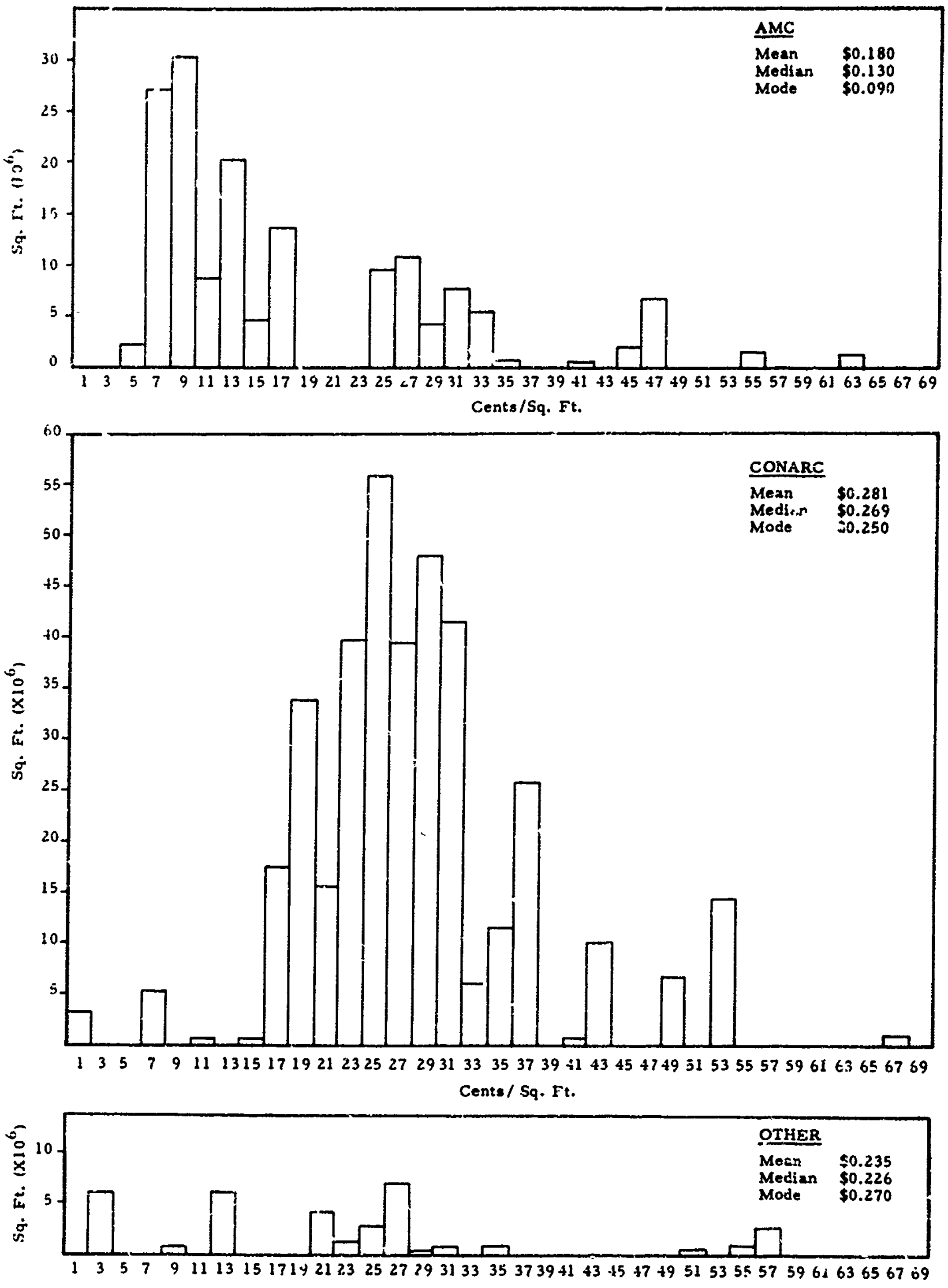
The quantitative analysis of the RPMA should be interpreted to mean that the introduction of the IFS will permit an improvement in the management of RPMA, which will be beneficial to the Army. The benefit may be realized in one of three ways: by reducing the budget and holding constant the effectiveness of RPMA management; by holding the budget constant and increasing the effectiveness; or by increasing the RPMA budget, thereby further increasing management effectiveness. It is beyond the scope of this analysis to recommend which of those three ways is preferred.

Management effectiveness, for purposes of this analysis, should be thought of in terms of the influence managers have upon facility condition as well as other factors, such as facility utilization. That is, for a given amount of funds, effective managers will attain a higher level of condition and utilization of facilities. They will accomplish that by allocating their funds more efficiently.

Two separate approaches to the estimation of RPMA benefits are taken. The first is based upon a detailed examination of RPMA data for one fiscal year (1968), and the second examines total RPMA data for many fiscal years. Both approaches are based on the qualitative statements put forth above, pointing out that certain deficiencies will be alleviated (in RPMA), leading to more uniform maintenance. The two approaches estimate the value of achieving uniform maintenance. The single fiscal year approach examines the frequency distribution of unit cost; the multiple fiscal year approach compares the unit costs of an installation which has been maintained uniformly over the years to two other installations known to lack uniformity of maintenance. Because the value of benefits expected from an information system is necessarily nebulous, the credibility of the estimates should be enhanced if the two approaches give results that are approximately equal.

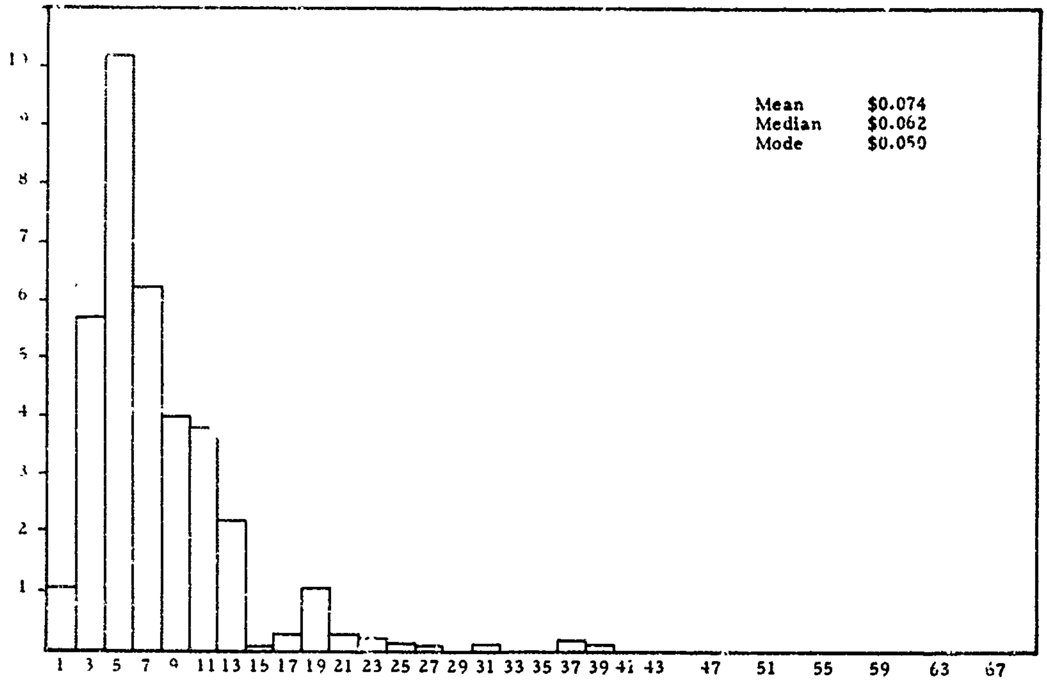
1. Single Fiscal Year Approach

Maintenance funds are currently allocated without clear visibility of actual requirements. Allocations are based largely upon expenditures during the previous year. The result is that at an installation where the level of maintenance has been inadequate, it will continue to be inadequate. Installations receiving more funds than necessary will continue to receive more. This method of allocating funds is inefficient, and, as can be seen from the frequency distributions describing unit cost as a function of the number of units (square feet and square yards), the method results in a large variance among unit costs. (See Exhibits IV-4 through IV-6). Improved visibility of actual maintenance needs, to be provi by the IFS, will reduce funding inequities, and increase uniformity of maintenance from installation to installation, resulting in a near-normal distribution.



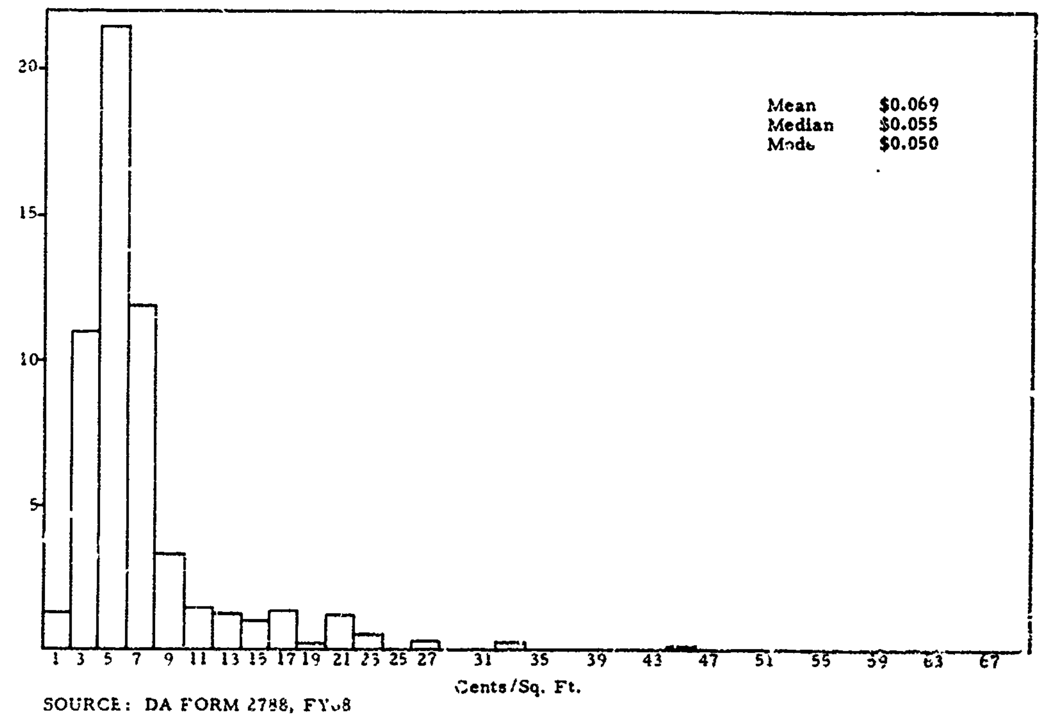
Source: DA Form 2788, FY 58

EXHIBIT IV-4 COST/SQUARE FOOT OF BUILDING MAINTENANCE



SOURCE: DA FORM 2788, FY68

EXHIBIT IV-5 COST/SQUARE YARD OF SURFACE AREA MAINTENANCE



SOURCE: DA FORM 2788, FY68

EXHIBIT IV-6 COST OF UTILITIES MAINTENANCE/SQUARE FOOT OF BUILDINGS SERVICED

The frequency distributions were prepared by counting the number of square feet or square yards (units) whose cost per unit fell within each cell. Each cell represents a range of costs per unit, but for convenience in graphics only the midpoint of the cell is shown. For example, in Exhibit IV-4 the cell labelled 25 represents all those square feet whose unit cost falls within the range $0.241 through $0.260.

For purposes of estimating the value of more efficiently allocating RPMA funds, the following assumptions are made:

- IFS will lead to normally-distributed unit costs
- The mean unit cost will shift to become equal to the median unit cost.[1]

The above assumptions and approach to the estimation of benefits resulted from discussions with, and the independent work of, representatives of OCE, who also provided the data for the analysis, and advised PRC on the categories of RPMA costs that are subject to improved allocation.

These particular assumptions are based upon the RPMA benefits (deficiencies expected to be alleviated) discussed in the preceding section. It seems unreasonable to expect that the distributions of unit cost would remain unchanged or that they would become more skewed if they change. (See Exhibit IV-7). Hence, the assumption was made that the resulting distribution would approach normality. Likewise, it would be unreasonable to expect the mean unit costs to increase or even remain the same if management effectiveness is held constant. If unit cost is to shift, then the benefits discussed in the preceding section certainly suggest a shift to some lower figure.

Also, there is no reason to expect the median to change. Most installations receiving an RPMA budget greater than the current median

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[1] A characteristic of a normal distribution is that the mean, median and mode are equal. The <u>mean</u> (arithmetic) of a set of <u>n</u> observed numbers is the sum of the numbers divided by <u>n</u>. The <u>median</u> is the magnitude of the middle case—the value that has half the observations above it and half below it. The <u>mode</u> is the value that occurs most frequently.

will probably continue to receive funds greater than the current median, although by a lesser margin. And those installations receiving less than the current median will probably receive more funds in the future, but less than the median. Therefore, the median should remain constant. Because the mean, median and mode become equal in a normal distribution, it seems reasonable to expect the mean to shift to either the median or the mode. The mode (most frequently observed unit cost) is subject to rather wide variation, and is an unstable measure of central tendency. The median is a more stable measure of central tendency, and that assumption results in conservative estimates, relative to the mode.

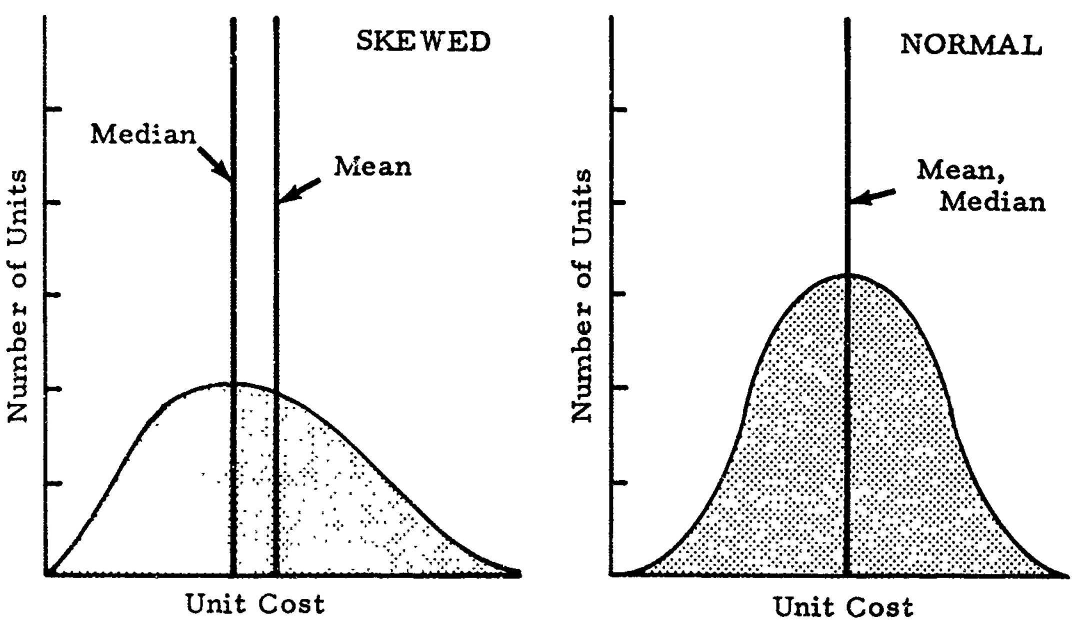

EXHIBIT IV-7 GENERIC FREQUENCY DISTRIBUTIONS ILLUSTRATING METHODOLOGY

For this analysis, data were collected from individual installation Repairs and Utilities Technical Data Reports, DA Form 2788, for fiscal year 1968. The Annual Summary of Operations (Red Book) for FY68 did not contain data by installation; the FY69 Red Book does, but it was published subsequent to this data collection activity. A cursory check on the FY69 data suggests that the same relationships hold.

Maintenance data were collected for buildings (9060.2000), grounds (9060.3000), surfaced areas (9060.5000), and the following elements of utilities:[1]

9060.1100	Water Systems
9060.1200	Sewage Systems
9060.1300	Electric Systems
9060.1500	Refrigeration and Air Conditioning
9060.1900	Other Utilities
9060.1410	Boiler Plants, High Pressure
9060.1420	Heating Plants, High Pressure
9060.1430	Heating Plants, Low Pressure
9060.1440	Other Heating Support

In the case of buildings maintenance, the installations were divided as follows: AMC, CONARC, and Other. The latter category includes The Surgeon General, U.S. Military Academy, Army Map Service, Military Traffic Management and Terminal Service, and the Army Security Agency. The installations are divided into three groups— AMC, CONARC and Other—because the type of facility represented by each group is distinctly different from the others. Utilities and surfaced areas are similar (in a statistical sense) for all installations, and are therefore not divided.

The data on grounds maintenance show that the unit costs (cost per acre of grounds maintained) vary from very high cost areas, such as hospital grounds, to extremely low cost areas such as the White Sands Proving Grounds. The result is an awkward distribution not susceptible to meaningful analysis by the above methodology. Therefore,

[1] The code numbers are from Army Management Structure (AMS); see AR 37-100-xx, the Army Management Structure (Fiscal Code).

this area is dropped from the final analysis, even though it is expected that the IFS will permit more efficient management of grounds maintenance.

Exhibit IV-8 shows the summary statistics leading to the calculation of benefits expected in RPMA, buildings, utilities and surfaced areas for CONUS.[1] As an example of the calculation, note the number of square feet of buildings within the AMC—155.6 million; note the difference between the mean and median unit costs—0.180 minus 0.130, or 0.050 cents per square foot. If the mean shifts to equal the median after the IFS is implemented, as assumed, the benefit attributable to the IFS is the product of $0.05 times 155.6 million square feet, or about $7.8 million.

In summary, this technique for quantifying expected benefits yields a result of about $25 million. Grounds maintenance has been excluded from this analysis, so one would expect the total RPMA benefits to be in excess of those calculated. Grounds maintenance amounted to about $20 million in FY 68, or about 10 percent of the costs treated in this analysis.

2. Multiple Fiscal Year Approach

To add to the credibility of estimates made under the first approach, the RPMA unit cost for an installation which has not been uniformly maintained over the years is compared to the unit cost of one that has. An effort was made to select installations affected by nearly the same climatic conditions. For Benning was selected to represent a uniformly-maintained installation, Fort Polk to represent the other extreme, and Fort Campbell as an intermediate example. Fort Benning has been open continuously during the period examined; Fort Polk has been opened and closed frequently, and Fort Campbell's population has fluctuated over a wide range. Therefore, in order of degree of uniform maintenance received, the three installations rank from high to low as follows; Benning, Campbell, Polk.

[1] The data and calculations supporting this analysis, due to their volume, are retained by the IFSO as working papers.

EXHIBIT IV-8 SUMMARY STATISTICS—RPMA BENEFITS BASED ON FY68 DATA

Maintenance Activity	Maintenance		Mean Cost/Unit	Median Cost/Unit	Benefit $\$ \times 10^6$
	Cost, $\$ \times 10^6$	Unit $\times 10^6$			
1. Buildings	142.6	568.3			
A. AMC	28.1	155.6	0.180	0.130	7.8
B. CONARC	106.2	377.6	0.281	0.269	4.7
C. Other	8.3	35.1	0.235	0.226	0.3
2. Utilities	39.5	568.9	0.069	0.055	8.2
3. Surfaced Areas	26.0	352.2	0.074	0.062	4.2
Total	$208.1				$25.2

SOURCE: DA Form 2788, FY68

NOTE: All units are square feet, except Surfaced Areas, which are in square yards.

An attempt was made to collect data for those three installations over a 30-year period. This failed. We were able to obtain data from 1951 through 1969, but there are gaps from 1952 to 1954 and from 1959 through 1963 (see Exhibits IV-9 through IV-11). These data suggest that the lack of a uniform maintenance policy is costly.

RPMA expenditures are shown as collected from the R&U Technical Data Reports, and those dollar amounts are then adjusted to reflect constant 1969 dollars on the basis of the construction cost index shown in Exhibit IV-12. On the basis of the statistics collected, calculations were made for the utilization ratio (square feet per man), the RPMA cost per square foot, and the cost per man. These results, respectively, are shown in Exhibits IV-13 through IV-15. To show graphically the relative uniformity of maintenance at the three forts, the cost per square foot is plotted as it relates to utilization (Exhibit IV-16), and the cost per man is plotted as a function of utilization (Exhibit IV-17). In both cases, it is clear that maintenance has been more uniform over the past two decades at Benning than at either of the other two forts, and Fort Campbell appears more uniform than Fort Polk.

The data in the tables and graphs indicate that the average RPMA cost per square foot of facilities per year is a function of continuity in maintenance activities. The average cost per square foot per year (in 1969 dollars) for Fort Benning was $.62, for Fort Campbell $.71 (14-1/2 percent higher than Benning), and at Fort Polk $.91 (46.7 percent higher than Benning). See Exhibit IV-18.

One may argue that there are other reasons for the difference in cost per square foot. For example, Fort Polk has very few permanent facilities, whereas Fort Benning has more permanent than temporary facilities. Note, however, that Fort Campbell also has more permanent than temporary facilities, and its cost per square foot is higher than at Benning. Therefore, on the basis of the information displayed here, we conclude that essentially all of the difference in unit costs between Fort Benning and Fort Campbell is due to the difference in continuity or uniformity of maintenance. The difference is approximately 15%.

A reallocation of RPMA funds, while holding management effectiveness constant, would have as a primary objective the reduction of the

EXHIBIT IV-9 RPMA STATISTICS, FT. BENNING

FY	RPMA ($000 Current-Constant 1969)	Population	Sq. Ft. M	As Of	M Sq. Ft.	
					Perm.	Temp.
51	7,401 (11,718)		14,618	4Q 51	4,445	10,173
52						
53						
54						
55	6,203 (9,167)	46,477	16,499	4Q 56		
56	6,990 (9,786)	46,483	16,991	4Q 57		
57	5,725 (7,691)	49,026	17,329	3Q 58	7,095	9,896
58	6,904 (9,182)	47,001	16,184	4Q 59	10,345	5,839
59						
60						
61						
62						
63						
64	12,610 (14,974)	59,834	20,085	30 Jun 64		
65	13,332 (15,286)	65,689	20,794	30 Jun 65		
66	12,611 (13,862)	56,256	20,621	30 Jun 66	11,754	8,867
67	13,424 (14,283)	50,753	20,602	30 Jun 67		
68	5,828 (6,009)	68,999	21,332	30 Jun 68		
69	15,578	70,179	21,353	30 Jun 69		

EXHIBIT IV-10 RPMA STATISTICS, FT. CAMPBELL

FY	RPMA ($000 Current-Constant 1969)	Population	Sq. Ft. M	As Of	M Sq. Ft.	
					Perm.	Temp.
51	4,101 (6,493)		8,478		970	7,508
52						
53						
54						
55	4,522 (6,683)	14,616	10,730	4Q 56		
56	4,486 (6,280)	22,805	11,239	4Q 57		
57	4,464 (5,997)	25,188	11,057	3Q 58		
58	4,876 (6,485)	28,601	10,085	4Q 59	4,741	5,344
59						
60						
61						
62						
63						
64	6,747 (8,012)	30,095	11,973	30 Jun 64		
65	5,791 (6,640)	34,452	11,334	30 Jun 65		
66	7,593 (8,346)	26,609	11,489	30 Jun 66	6,625	4,864
67	15,757 (16,765)	45,902	11,567	30 Jun 67		
68	3,848 (3,967)	4[illegible],155	11,662	30 Jun 68		
69	10,380	37,259	11,715	30 Jun 69		

EXHIBIT IV-11 RPMA STATISTICS, FT. POLK

FY	RPMA ($000 Current-Constant 1969)	Population	Sq. Ft. M	As Of	M Sq. Ft. Perm.	M Sq. Ft. Temp.
51	7,526 (11,916)		7,890			7,890
52						
53						
54						
55	769 (1,136)	19,375	7,898	4Q 56		
56	3,166 (4,432)	19,226	7,934	4Q 57		
57	5,387 (7,237)	13,845	7,946	3Q 58		
58	5,721 (7,609)	9,169	4,369	4Q 59	37	4,332
59						
60						
61						
62						
63						
64	6,816 (8,094)	24,358	7,972	30 Jun 64		
65	6,599 (7,566)	26,313	8,527	30 Jun 65		
66	6,779 (7,451)	29,521	8,555	30 Jun 66	442	8,113
67	7,626 (8,114)	35,000	8,565	30 Jun 67		
68	7,661 (7,899)	33,225	8,732	30 Jun 68		
69	7,580	32,404	8,741	30 Jun 69		

EXHIBIT IV-12 CONSTRUCTION COST INDEX

Fiscal Year	Index	Fiscal Year	Index
51	84	61	104
52	86	62	107
53	88	63	109
54	88	64	112
55	90	65	116
56	95	66	121
57	99	67	125
58	100	68	129
59	102	69	133
60	103		

Sources: (a) U.S. Dept. of Commerce, Office of Business Economics, Business Statistics 1967, p. 51.

(b) International Monetary Fund, International Financial Statistics 1969, pp. 324-325.

EXHIBIT IV-13 UTILIZATION RATIO

	Sq. Ft./Man		
FY	Benning	Campbell	Polk
51			
52			
53			
54			
55	355	734	408
56	366	493	413
57	353	439	574
58	344	353	476
59			
60			
61			
62			
63			
64	336	398	327
65	317	329	324
66	367	432	290
67	286	252	245
68	309	270	263
69	304	314	270

EXHIBIT IV-14 COST PER SQUARE FOOT

	RPMA $(1)/Man		
FY	Benning	Campbell	Polk
51	.801	.765	1.510
52			
53			
54			
55	.555	.622	.143
56	.443	.558	.558
57	.433	.542	.910
58	.567	.643	1.741
59			
60			
61			
62			
63			
64	.745	.669	1.015
65	.735	.585	.887
66	.672	.726	.870
67	.693	1.449	.947
68	.281	.340	.904
69	.729	.886	.867

Note: (1) 1969 dollars.

EXHIBIT IV-15 COST PER MAN

	RPMA $(1)/Man		
FY	Benning	Campbell	Polk
51			
52			
53			
54			
55	197	457	59
56	212	275	231
57	157	238	523
58	195	227	830
59			
60			
61			
62			
63			
64	250	266	332
65	233	193	288
66	246	314	252
67	198	365	232
68	87	92	238
69	222	279	234

Note: (1) 1969 dollars.

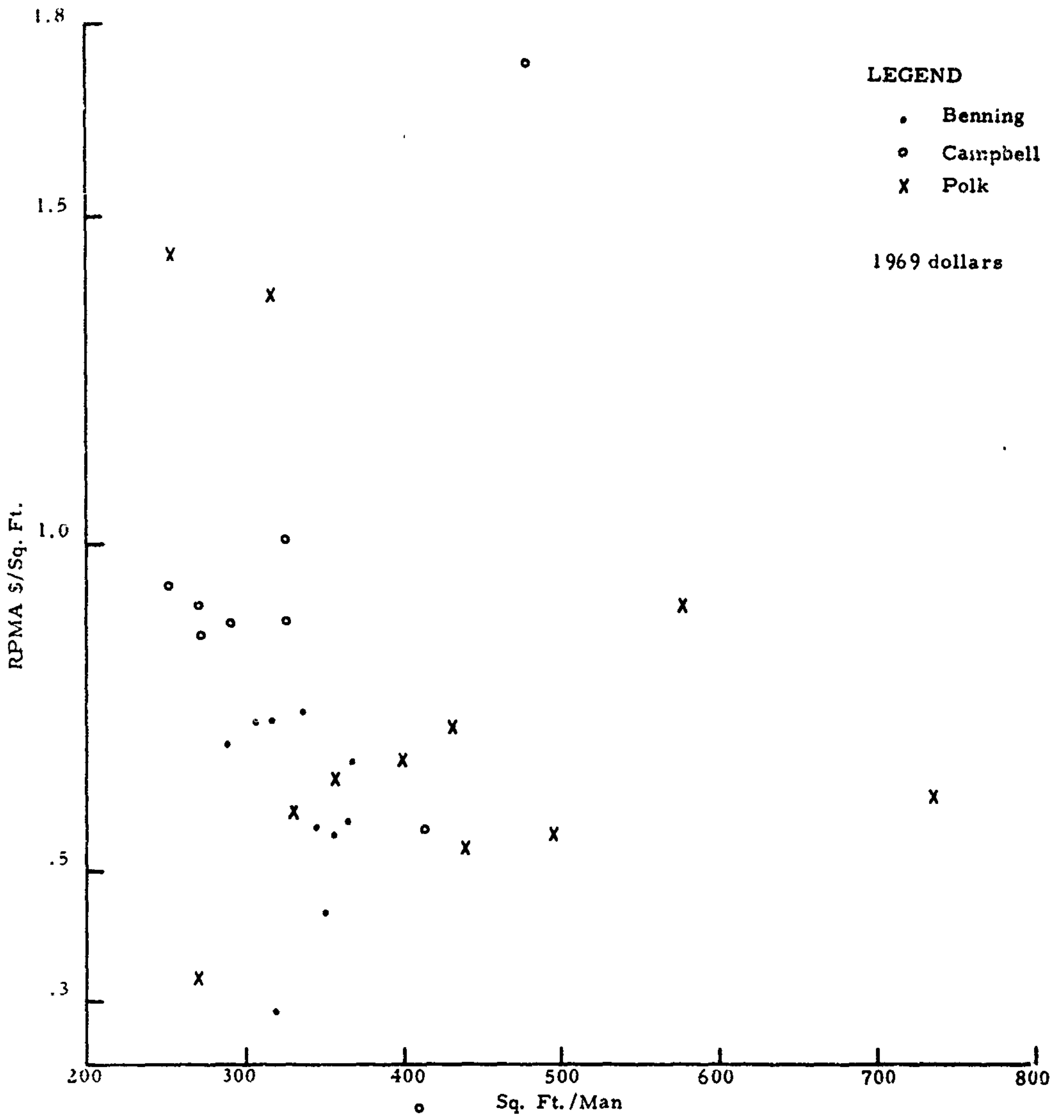

EXHIBIT IV-16 COST PER SQUARE FOOT AS A FUNCTION OF UTILIZATION

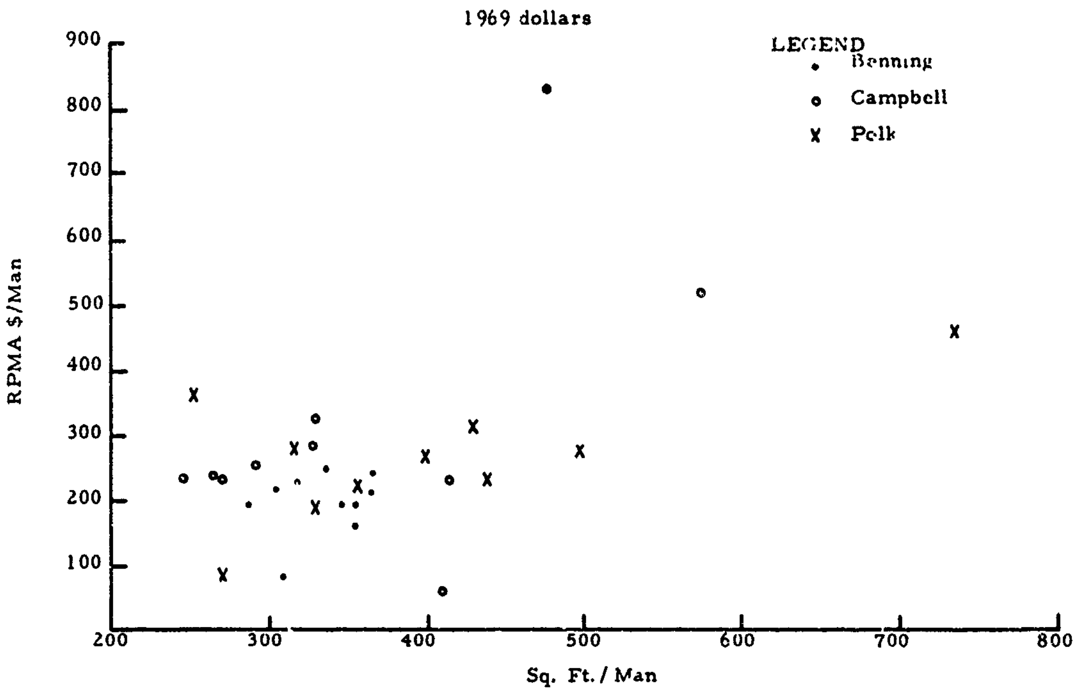

EXHIBIT IV-17 COST PER MAN AS A FUNCTION OF UTILIZATION

EXHIBIT IV-18 AVERAGE COST PER SQUARE FOOT PER YEAR

1969 Dollars	
	Cost
Benning	$.62
Campbell	$.71 (14.5% Higher Than Benning)
Polk	$.91 (46.7% Higher Than Benning)

Unadjusted Dollars	
	Cost
Benning	$0.49
Campbell	$0.57 (16.2% Higher Than Benning)
Polk	$0.74 (51.1% Higher Than Benning)

number of high-cost installations, the increase of medium-cost installations, and the reduction of low-cost installations. That is, a more equitable allocation would result in a narrower distribution of unit costs, and the net effect of providing uniform maintenance could be to reduce by 15 percent the costs of those installations having a unit cost equal to or greater than Fort Campbell. However, part of the savings resulting from high-cost installations should be reallocated to low-cost (inadequately maintained) installations.

Analysis of FY68 data shows that 52% of the square feet of buildings have unit costs as high or higher than Fort Campbell. Therefore, using buildings as a proxy for the RPMA budget, there are about $242 million (0.52 x $464 million) susceptible to 15% reduction due to uniform maintenance. That amounts to $36.3 million, part of which should be reallocated. There are 19% of buildings (measured in square feet) whose unit costs are lower than Fort Benning. Again, using buildings as a proxy, about $88 million in the RPMA budget is being devoted to maintenance of low-cost installations. If that amount is increased by 15%, bringing those installations nearer to the mean unit cost, the $13.2 million (0.15 x $88 million) of the $36.3 million could be reallocated, leaving a net reduction of $23.1 million. This, too, assumes management effectiveness to remain constant.

3. Summary of Quantified Benefits

On the basis of the two approaches taken to the estimation of benefits—the single- and the multiple-year approaches—the range of benefits appears to lie between $23 and $25 million. It is emphasized that the range estimated above is for RPMA benefits alone, not a comprehensive analysis of all tangible benefits. Because that range is more than sufficient to offset the additional costs, and because time did not permit a quantitative analysis of all benefits, that range is employed in the next section which relates benefits to costs. For that reason, it would be inappropriate to compare the benefit-cost ratio for the IFS to ratios for other competing projects.

V. COST-BENEFIT COMPARISON

A. General

The analysis of the economics associated with the design, development, and implementation of the CONUS-wide Integrated Facilities System takes the form of a cost-benefit study, where the costs of the system are compared to the benefits to be derived after it is implemented.

Additional resources, including personnel and equipment, necessary to the acquisition and operation of the IFS are reduced to a common denominator, dollars. Those dollar estimates are divided among the appropriate budget programs and time-phased. In the case of benefits, the aim was to identify essentially all tangible and intangible benefits, and to assess the value of some of the tangible ones. The hope was that the value of the benefits measured would be sufficiently high, and credible, to offset the additional costs expected to be incurred.

The analysis of costs and benefits must be viewed as the first step in what is sure to be a progression of estimates, each a bit more refined and accurate than its predecessor. That is, as the DFSR and the automatic data processing concepts become better understood and defined, it will be possible to project costs more accurately and comprehensively. Possibly, the assessment of benefits will continue to defy precise measurement; however, benefits not measured in this study may lend themselves to measurement in the future.

Exhibit V-1 shows the summary of costs and the range of benefits, and their totals discounted at 10 percent.[1] The estimate of benefits

[1] See AR 37-13. "Present Value/Time Value of Future Cash Flows - In every investment, explicit recognition should be given to the fact that a dollar today is worth more than a dollar tomorrow because of the interest cost which is related to all Government expenditures which occur over time. Thus, an annual savings or cash-inflow projected for tomorrow has a present value less than its undiscounted dollar value. Dollar benefits which accrue in the future cannot be compared directly with investments made in the present because of this time value of money. Discounting is a technique for converting various cash flows occurring over time to equivalent amounts at a common point in time—considering the time value of money—to facilitate a valid comparison."

EXHIBIT V-1 IFS COST AND BENEFIT SUMMARY (COSTS AND BENEFITS IN MILLIONS)

	Fiscal Year											
	71	72	73	74	75	76	77	78	79	80	81	82
Personnel Costs	1.993	3.310	5.869	9.538	8.340	6.997	6.997	6.997	6.997	6.997	6.997	6.997
ADP Costs	.092	.357	.617	1.548	1.620	1.620	1.620	1.620	1.620	1.620	1.620	1.620
Total Costs	2.085	3.667	6.486	11.086	9.960	8.617	8.617	8.617	8.617	8.617	8.617	8.617
Total Benefits High				8.1	22.3	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Total Benefits Low				7.4	20.5	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Discount Factor (10%)	.954	.867	.788	.717	.652	.592	.538	.489	.445	.405	.368	.334

Discounted Costs - 52.0

Discounted Benefit Costs: High - 99.6

Low - 91.6

includes no value for tangible benefits that were not measured, and no value for the intangible benefits discussed in Section IV.

B. Conclusions

On the basis of the above, considering the stage of development of the IFS, it is concluded that:

- The benefits outweigh the costs by an amount sufficient to make the introduction of the IFS an economically attractive alternative for the Army.
- Additional refinements to this analysis, especially to the estimated costs that are the basis for budgetary requests, should be made as the IFS concept and definition progress.

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13. ABSTRACT

This report contains estimates of the benefits and costs associated with the development, implementation and operation of an Army CONUS-wide Integrated Facilities System (IFS). All additional costs expected to be incurred by IFS are estimated. These costs include personnel and Automatic Data Processing (ADP) requirements. All of the IFS benefits are addressed in a qualitative manner; the benefits associated with the Real Property Maintenance Activity (RPMA) are also treated quantitatively. The expected value of benefits more than offsets the expected additional costs, when both costs and benefits are discounted at 10 percent. The report concludes that the acquisition of IFS is an economically attractive opportunity for the Army. (U)

14. KEY WORDS

Benefit Cost Analysis
Budgeting
Construction Management
Decision Making
Economic Analysis
Facilities
Facilities Management
Information Systems
Logistics Management
Logistics Operations
Logistics Planning
Logistics Readiness
Maintenance
Management Engineering
Management Planning
Management Systems
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